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The Naturalist

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Published by the Yorkshire Naturalists' Union

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YORKSHIRE MAYFLIES

LESLIE MAGEE

Presidential Address to the Yorkshire Naturalists' Union, Doncaster, 3 December 1994

I begin this address with a quotation by the Rev. A. E. Eaton in his 1883-88 monograph on the *Ephemeridae*: "On many accounts these insects are very eligible subjects for scientific research: but so long as they are ill known, and their exact identification is a matter difficult of accomplishment, their employment in any branch of zoological learning is surrounded with disadvantages too patent to need identification." This quotation is highly significant in relation to the content of the remainder of my address.

The name *Ephemeroptera* comes from the Greek *Ephemeros*, lasting for a day; *pteron*, wing. The Germans call the insects *Eintagsfliegen*, the one day fly; the French, *Ephémère*. The common name 'mayfly' is today applied generally to all British species, notwithstanding an unsuccessful attempt in recent years to rename them dayflies. Originally, anglers applied the name 'mayfly' to the two best known and the largest species, viz. *Ephemera danica* and *E. vulgata*. The name 'mayfly' was given to the larger species of stoneflies and to the larvae known as stonefly 'creepers' and this name still applies in some parts of northern England. The habits of the stoneflies and the descriptions of the insects in angling literature are numerous and do not give rise to confusion today. The main hatch of these two species is during June, when they are greedily devoured by birds and fishes. The reason for the insects not being called 'juneflies' rather than mayflies is that during the period when the Julian calendar was in use the peak period of the hatch was towards the end of May.

History

About 2,400 years ago the Greek philosopher Aristotle wrote briefly about an animal which emerged from a river near the Black Sea. It had four wings, four feet and had a life span of only one day. It was called *Ephemeron*, i.e. one day living. About 200AD Claudius Aelianus repeated the same story with a description of catching trout or grayling in a river in Macedonia with an artificial fly made of wool and feathers. Occasional mention is made in the translations of the classics of the animal *Ephemeron*, but it is not until the 15th century that there appeared descriptions of insects which we may confidently judge to be mayflies. Julius Caesar Scaliger (1484-1558) described an aquatic insect with a split tail (two or three ends) which was almost certainly a mayfly. In 1496 Wynkyn de Worde, a pupil of Caxton, printed at Westminster *The Treatise of Fishing with an Angle*. The author is unknown but it has been attributed to Dame Juliana Berners, an Abbess of St. Albans. It is famous for the description of twelve artificial flies, copied from natural insects, and the months of the year when they were to be used. The Maure (Mulberry-coloured) Fly and the Tandy with a body of tan coloured wool and wings of the lightest feather of the mallard can be nothing but two copies of the Mayfly in different states (imago or sub-imago). These patterns, known as the Drakes, were plagiarised by generations of writers of angling books until the end of the 18th century.

The Entomologists

In 1634, a Dutchman, Outgert Cluyt (Augenius Clutius) published a book which described and illustrated (although not very well) an insect which hatched in vast numbers on the Rhine. After this date there was no doubt whatever what animal was intended by *Ephemeron*. Forty years later Jan Swammerdam published his marvellous description of the life history of the mayfly *Palingenia longicauda* under the title of 'Ephemera Vita'. This insect, which is now extinct on the Rhine, hatched in millions ('as thick as snow flakes in winter').

In 1903, Professor L. C. Miall, a former President of the Yorkshire Naturalists' Union, wrote *The Natural History of Aquatic Insects* and devoted a whole chapter to the Mayflies.

This included a translation of Swammerdam's work which described in detail the anatomy of the insects and their life cycle. In the same chapter Miall quoted the writings of Réaumur on the mayfly, taken from the 12th mémoire of his sixth volume of *The History of Insects*.

By the end of the 18th century, 16 of the now known total of 48 recognised British species had been given scientific names by entomologists, but there was another group of people working on the natural history of aquatic insects. These were the angler-naturalists, almost entirely amateurs among whom, perhaps, the best known to naturalists is Charles Cotton, because his work is included in the later editions of *The Compleat Angler* written by his friend Izaak Walton. This work, said to have been written in less than a week, was Part 2 of *The Compleat Angler* published in 1676 and was entitled 'How to angle for Trout and Grayling in a Clear Stream'. The work lists artificial flies for every month of the year and gives a description of the mayfly's short existence as a winged insect. Cotton was educated at Cambridge and lived the life of a country gentleman (albeit impoverished) at Beresford Hall, situated closed to the banks of the R. Dove in Derbyshire.

During the exuberant days after Waterloo the country came to life and there was a spate of books on all aspects of natural history, partly inspired by the writings of Gilbert White of Selborne and his contemporaries, several of whom were members of the Royal Society and who were to become members of the Linnean Society, founded in 1788. Simultaneously there appeared books on angling, shooting and hunting; the earlier works were mostly mere copies or blatant plagiarisms passed off as original works but now, with the opportunity to travel freely, came new authors. Most of the books were poorly illustrated, making identification of aquatic insects difficult.

Suddenly out of the blue in 1836 came a book that made easier identification of the common insects seen on or around water. It was the *The Fly-Fisher's Entomology* by Alfred Ronalds. The hand-coloured copperplate engravings have never been surpassed, making it possible for some species to be identified with certainty from the plates alone; moreover the scientific classifications were accurate for the period, following those of Linnaeus (although the orders and genera have in most cases been superceded).

Ronalds' observations were made on the little R. Blithe in Staffordshire where he built an observatory at the water's edge, with windows so obscured that the feeding trout were undisturbed.

There were others in Yorkshire observing and recording in detail the insects which were the food of the trout and grayling, all keen naturalists in their own way; among these were William Pilling of Pool Mill, *List of Flies for ye River Wharfe*, 1794; John Swarbrick, Farmer of Austby, *List of Wharfedale Flies*, 1807; T. C. Hofland, *The British Angler's Manual*, 1839; Michael Theakston, *A List of Natural Flies taken by Trout, Grayling and Smelt in the streams of Ripon*, 1853.

Hofland was a wealthy landscape artist who often stayed at the shooting lodge at Bolton Abbey as a guest of the Duke of Devonshire but who also travelled widely throughout the British Isles. Theakston was born at Ripon in 1786 and died there in 1866. His book is remarkable for the excellent engravings of terrestrial and aquatic insects which were drawn from life over a long period of time. The observations were made mainly on the Yore and the little R. Skell which flowed past his house in Waterskellgate.

The publication of Ronalds' work did not solve the problem of identification because the use of local and vernacular names continued until well into the 20th century; moreover they were applied to different insects in different parts of the country and the commoner the insect the more names there were. Some, like that of the Greendrake, *E. danica*, go back to the *Treatise* and there are others, such as the Primrose Dun, *Heptagenia sulphurea*, of whose identification there can be no doubt; we can obtain some idea of their distribution and abundance in the past from studies of the angling literature (Magee 1994).

The Yorkshire Entomologists

The results of the work of the Yorkshire entomologists were somewhat meagre and scattered and there was no published list of Yorkshire records. Eaton's monograph

(1833-88) referred to earlier had a few records from the North of England but none from Yorkshire. The Ephemeroptera were apparently totally neglected by the naturalists in Victorian times and no list appears in the *Victoria County History for Yorkshire* published in 1907. The first published list of Yorkshire mayflies was that of Prof. E. Percival and H. Whitehead in the *The Entomologist's Monthly Magazine* in 1927. The list appeared in the same year as the death of Geo. T. Porritt.

George T. Porritt (1848-1927) had dominated the Entomology Section of the YNU over a long period of time. He made his first contribution to *The Entomologist* in 1865 when still a youth of 17. By 1870 he was becoming a recognised authority on Yorkshire Lepidoptera and in 1872 became a Fellow of the Linnean Society. Having seen the demise of *The Naturalist* (1865-67) and the *Yorkshire Naturalists Recorder* (1872-1873), he made another bid for success in August 1875 with the launching of *The Naturalist* under the joint editorship of Charles P. Hobkirk and G. T. Porritt. Porritt's name was to appear on the title page as an assistant editor for another 51 years. He was President of the Union in 1900.

Porritt was a dedicated collector of insects and welcomed specimens from other collectors. In 1897 he made a request in *The Naturalist* for specimens of the Neuroptera and the Orthoptera but specifically excluded the Ephemeridae (sic) {Mayflies}, "which I do not propose to touch for the present". In 1920 Porritt wrote in his annual report in *The Naturalist* "Still no mayflies". Porritt's discouragement of the collecting of mayflies must have played some part in the apparent lack of interest of the entomologists in the order. As a result the two decades after his death was the period of the greatest interest and activity in the Yorkshire mayflies.

The Porritt Collection of Insects

The Porritt Collection of Macro-Lepidoptera consists of 23,000 specimens housed in 71 cabinet drawers. His collection of Neuroptera (Mayflies, Dragonflies and Caddis flies) and Orthoptera (Earwigs, Grasshoppers, Crickets and Cockroaches) comprised 16,000 specimens housed in 65 cabinet drawers. The Lepidoptera collection was purchased by subscription and is now kept at the Tolson Memorial Museum in Huddersfield, together with the Neuroptera and Orthoptera collection which was his personal bequest; it does not however contain any mayflies.

In 1925 the YNU set up a River Investigation Committee with monthly collecting from the Wharfe at Grassington and Harewood; collecting at Beckermonds, Ilkley and Ulleskelf was to be twice yearly. The first secretary of the Committee was C. A. Cheetham. In 1926, the names of J. R. Dibb and W. C. Hincks appear in the excursion reports in *The Naturalist*, and in 1929 came the first Fresh Water Biology Report, edited by J. M. Brown. This was followed by the First Ephemeroptera Report in 1932 and the names of several entomologists working on the order were acknowledged. In 1945 J. R. Dibb's paper *Yorkshire Mayflies or Ephemeroptera* was published as part of the *Transactions* of the YNU. This list of 37 species recorded in Yorkshire covered all the vice-counties, although it is far from comprehensive in terms of distribution. It also included a bibliography and remains the basis for all later work. In 1945 H. Whitehead published additional records for 18 species and in 1946 J. R. Dibb published a short Addenda and Corrigenda to his 1945 paper.

Between 1927 and 1947 was the period of the greatest activity and research in this field by members of the Union. The report produced jointly by Percival and Whitehead on the ecology of rivers belong to this period. In the following decades interest in fresh water biology declined and there were few active workers interested in the mayflies. During the 50 years which have elapsed, records of mayflies published in *The Naturalist* are sparse and the information of the YNU entomological record cards for the Ephemeroptera is indeed meagre. However, since the relaunching of the Fresh Water Biological Section of the YNU in 1989, many new records from all the vice-counties have been added and the distribution and life cycles of the less common upland species, e.g. *Ameletus inopinatus* and *Siphlonurus lacustris*, are becoming better known.

My own interest in the mayflies goes back more than 60 years. I had an interest in fishing from an early age and was aware of the importance of the mayflies from *The Compleat Angler*. In 1928, I visited Bolton Abbey for the first time with a school party and persuaded an angler to show me the contents of his fly-wallet. I clearly remember the fine imitations of the Greendrake. After many years living in the north-east and other parts of the county I came to live quite close to the river at Pool-in-Wharfedale. Eric Thompson, who is still active in the Union and who had been a pupil of Whitehead, reminded me that much of the investigation work which had formed the basis of Percival and Whitehead's report had been done on the Wharfe at Pool and Harewood. He suggested that I might wish to re-investigate the river fauna after an interval of 40 years because very little had been done in the meantime; moreover the Executive of the YNC had already approved the re-activation of the defunct Fresh Water Biological Section and the time might be opportune to attempt to do so. A further 23 years were to pass before the Section was reformed. Eric Thompson possessed several of Whitehead's published papers and kindly gave them to me. There have been very few entomologists in the YNU studying the Yorkshire mayflies during that period.

However, the predecessor of the Yorkshire Water Authority (YWA), the Ouse River Board, had partly financed the work of Percival and Whitehead and more extensive work had been done since 1956 by them and later by their successors the YWA. In 1967 the YWA began monitoring the invertebrates at 60 sites throughout the area of the county which they controlled, and by 1976 had carried out surveys at more than 1,000 sites. The sampling of invertebrates was encouraged by the Department of the Environment due to the growing awareness of the need for a biological classification of rivers as well as a chemical one.

The Water Quality of Rivers

The demand for pure water for potable and industrial use had increased rapidly after 1945 and the supplies of the impounded water from the upland reservoirs became inadequate, as was shown dramatically in 1959 when supplies in the Washburn Valley reservoirs failed and they virtually dried up. Additional supplies were sought and although some new reservoirs were built it was clear that new supplies would have to come (at least in the short term) from boreholes and river abstraction. The consequences of this have had profound effects on the flora and fauna and have created problems which are still far from being resolved. Rivers are more prone to pollution than reservoirs since pollution can be spread downstream. Chemical analysis is one method of assessing pollution but it was already well known that invertebrate sampling on a regular basis could be used to assess water quality and to determine short and long term changes in quality. The development of systems of classification of river quality by invertebrate sampling was encouraged by the authorities and a number of systems came into use. All are based on the presence or relative abundance of families of aquatic invertebrates, which are affected by differing degrees of organic pollution. The presence of these groups can be linked to a standard test of a water sample, the Biochemical (Biological) Oxygen Demand (BOD).

Among the systems which have evolved are: Trent Biotic Index (Woodiwiss); Biotic Score (Chandler 1970); Biological Monitoring Working Part Score (BMWP). The latter is the one most widely used at the present time. The method is not complicated and in most cases it is not necessary to determine the invertebrates collected down to species.

A score on a scale of 10 down to 1 is allotted to groups of invertebrates collected in a sample; mayflies, caddis flies and stoneflies mostly score 10; in the lowest groups are: some molluscs = 3, Chironmids = 2, all *Oligochaeta* = 1. The total score is added to produce an average score per taxa which can be directly related to a classification scale. A computer programme RIVPACS is also under development but at the present time it is not in general use.

Since mayflies at some time of the year may account for as much as 20% of the biomass, they are an important integer in any invertebrate classification system.

In the case of the Ephemeroptera the surveys are carried out entirely upon the nymphs and although if they are well developed most can be identified fairly easily down to species, there are problems in doing so in some families, e.g. *Baetidae*, particularly when they are very small. It is for this reason that one of the most abundant species on the Wharfe, The Pale Watery, *Baetis fuscatus* is not separated in the YWA lists. It is necessary to explain that the eggs hatch as larvae and are termed nymphs as they develop; they resemble fairly closely the adult and after a series of moults (instars) emerge to become the winged sub-imago (the angler's Dun). The final metamorphosis is the imago (the angler's Spinner). However, the distribution records of the YWA collated between 1971 and 1976 are probably the largest group of records of Yorkshire mayflies available at the present time and voucher specimens identified by various authorities have been retained. Work has slowed down during the past decade although some of the work is not done by the National Rivers Authority (NRA). The other large group of records is that of the author who has identified and recorded adult insects as well as nymphs. The collection of nymphs throughout the year is simple; it can be done at specific locations and at different seasons. The observation of adults is more difficult for the following reasons:

1. Some species have a two year life cycle.
2. Some species are univoltine while others are bivoltine and this may vary in different years.
3. The emergence of the whole population of some species may occur in a very short period of time, so that records depend on the presence of the observer.
4. The period of emergence of the adults may take place over several weeks or even months and the numbers hatching may at times be quite small, e.g. *Baetis* spp.
5. Some species emerge at dusk or at dawn and the metamorphosis from sub-imago to imago is quite rapid, e.g. *Caenis* spp.
6. The adults are often difficult to locate in their shelter in high trees or even on bridges and buildings.
7. The populations of certain species are small and the duns emerge individually, e.g. *Heptagenia sulphurea*.
8. The less common species, which in Yorkshire are mainly confined to the uplands, appear to emerge over a very short period of time in good weather when the wind speed is low.

It is clear that a naturalist studying the Ephemeroptera and living close to a large river system has considerable advantages over the casual observer. The method of sampling invertebrates is by disturbing the bed by a set number of standard 'kicks' and collecting the invertebrates in a net; after sorting, this produces a reasonably reliable indication of the biological quality of a river; it is less so for lakes, reservoirs and deep tidal stretches where there are physical limitations in sampling. In rivers, the statistical variations can be complex; surveying may be hindered by the topography and the season of sampling (although it is mainly confined to Spring, Summer and Autumn). The aquatic and marginal vegetation was not taken into account in the earlier surveys and the biological effects of augmentation, abstraction and inter-river transfers has only begun to be investigated in recent years.

The Distribution of Ephemeroptera in Yorkshire

The maps showing the water quality of Yorkshire rivers equate closely to the distribution maps of the riverine species of the *Ephemeroptera* in the county. Apart from some genera of the *Caenidae* and the *Baetidae*, the abundance of mayflies, stoneflies and most caddisflies declines as the water quality deteriorates from Class 1 to Class 2. The higher levels of the rivers and their tributaries are swift flowing and mainly stony-bottomed and the invertebrate and vertebrate fauna are highly specialised. Mayflies also have a distinct preference for streams which have a pH value >7 although this may be directly related to the algae and microflora on which they feed. None of the British species are predators.

The most ubiquitous species are the *Baetidae*; one species, *Baetis rhodani*, called by

anglers the Large Dark Olive, is found in every Yorkshire river system and is widespread throughout the British Isles. It may be seen on the wing in small numbers during every month of the year and occurs in such varied habitats as the calcareous rills which drain into Malham Tarn to the deep slow-flowing waters of the Ouse. The stated periods during which the *Ephemeroptera* may be seen on the wing can be misleading; for instance, the peak hatch of *B. rhodani* in Yorkshire is during May and it appears to be univoltine in most years, being bivoltine in years when there is a prolonged drought and high water temperature.

Pond and Lake Species

Many of the upland reservoirs in Yorkshire have been created in steep-side narrow valleys and do not have large populations of mayflies; there are few natural lakes in Yorkshire but small ponds and disused gravel pits with macrophytes are likely habitats provided that they are not polluted. There are no British species which are only found in lakes and ponds, but certain species which are adapted to slow flowing rivers may be found in stillwater and reservoirs, particularly those which are formed by damming streams. The large mayfly *Ephemera danica* is widely distributed throughout Yorkshire on calcareous rivers but as the nymphs are silt burrowers they tend to be absent from fast flowing, stony-bottomed rivers unless the habitat has been modified. Occasionally this occurs naturally when a stream becomes blocked and silt accumulates, but more often when a dam has been built across the river, allowing deep silt to build up along the banks. This is typical of the R. Nidd which has a large greendrake population upstream of the weirs. If the weirs are destroyed, the insects usually disappear from that reach of the river, as is known to have happened at Arthington on the R. Wharfe. On the little R. Dove in Douthwaite Dale in North Yorkshire there is a large population of *E. danica* in deep silt washed down from the moors but this stream is calcareous and has a high pH value.

A close relative, *E. vulgata*, the anglers' Dark Mackerel, occurs in huge numbers in Swinsty Reservoir, in some adjacent reservoirs and in the Leeds/Liverpool Canal from Gargrave to the centre of Leeds. In the eastern side of the county it was once recorded from the Sea Cut at Scalby where its current status is not known. Its distribution is very local in England, occurring mainly in slow flowing rivers and meres in the west, but is spreading to man-made lakes and disused gravel pits in the Midlands and the south.

E. vulgata was first recorded on the Leeds/Liverpool Canal at Gargrave in 1927 and in 1931 at Winterburn Reservoir which is a supply reservoir for the Canal. It is remarkable that its spread via the Canal was unnoticed by the entomologists, although swarms were pointed out to me at Esholt by a Bradford naturalist in 1952 under the name of *E. danica*. The sub-imagos frequently rest on barges during cool weather and travel many kilometres in this way. My investigations of its occurrence in Cheshire and Lancashire when I lived there would indicate that the canal is the obvious route by which the species came into Yorkshire.

Two species of the *Baetidae*, *Cloeon simile* and *Cloeon dipterum*, the Pond and the Lake Oliver, have been recorded from Malham Tarn. On the record cards at Malham and in the YNU Malham Reports only *Cloeon simile* is recorded, but during the two-day YNU excursion to Malham in May 1993, only nymphs and adults of *Cloeon dipterum* were found. Extensive surveys of the Tarn were made from a boat during the excursion and a light trap was operated. Further surveys have not produced any specimens of *C. simile; C. simile* nymphs are usually found at a depth of *c.* 2 metres and have a preference as a habitat for the Water Milfoil *Myriophyllum spicatum*, which does occur in the Tarn. It is interesting too that *C. dipterum* is the only European mayfly which is ovi-viviparous; the female rests 10 to 12 days before returning to the water to oviposition, when the eggs hatch immediately on contact with the water. I have only once located resting, fertilised females.

25 Years of Studying The Yorkshire Mayflies

The author's approach was first to attempt to determine what changes, if any, in the

distribution and abundance of mayflies had taken place in the intervening years since Percival and Whitehead published their 1930 report. Fortunately, the exact dates of the surveys are given in the reports, making comparisons fairly reliable. The list of mayfly species recorded at Pool was unchanged but pollution from industry, agriculture and sewage was on a scale much greater than that noted at Pool Bridge between 1928/1930. The comparison of the abundance of the populations was more difficult but it was possible to make biological classification comparisons for some stations. In 1968 the river declined to class 2 downstream of Pool Bridge and mayflies declined in numbers towards the tidal reaches. Feeding Dippers are a good indicator of the presence of mayflies; they are not often seen downstream of Arthington Viaduct. In subsequent years, in spite of the improvements in sewage treatment, the quality did not improve dramatically and the industrial pollution was a source of concern. The maps showing the water quality of Yorkshire rivers between 1968 and 1994 equate closely to the distribution of mayflies.

The Macrophytes

The most noticeable change over the next 15 years was in the reduction in the river vegetation of the Wharfe. Limited information on the distribution of the macrophytes of Yorkshire rivers over the past 120 years may be obtained from the *Transactions* of the YNU and the *Floras* of F. A. Lees, W. G. Baker and J. F. Robinson. A more recent survey of the Wharfe was that of R. W. Butcher in 1933; this indicated for example, that the Water crowfoot *Ranunculus fluitans* was dominant in the swift portions and frequent in the slower portions. This plant does not occur on the Wharfe today and may be extinct in Yorkshire.

The Water Crowfoot *R. penicillatus* subsp. *pseudofluitans*, which had been a feature of the river, had decreased since the 1930s and had become virtually extinct upstream of Pool. The presence of macrophytes plays an important role in the abundance of invertebrates in any river system, resulting in some authors giving a pollution tolerance relating to groups of British macrophytes. Replanting of *R. penicillatus* subsp. *pseudofluitans* has been taking place systematically in the Wharfe from Grassington down to Harewood Bridge since 1990 and the plant is becoming re-established in well oxygenated parts of the river. The reappearance in huge numbers of a caddis fly *Brachycentrus subnubilus* on the mid-Wharfe is believed to be in part due to the increase of some macrophytes in recent years. Although the increase in macrophytes in some rivers is due to eutrophication, the presence of the mayflies in some numbers (except *Baetis rhodani*) does usually indicate good quality.

Current Research on the Ephemetoptera

The Fresh Water Biological Association published its first key to the *Ephemeroptera* by D. E. Kimmins in 1942, followed by a separate key to the larvae in 1961. Since the first publication there has been a growing interest in the order in Europe and in America, which has resulted in a large number of published references. There have also been several International Ephemeroptera Conferences. There are few aspects of the life cycle which have not now been studied. We now know that of the 48 British species, 30 occur mainly in running water and 18 in both running and standing waters.

In spite of the intensive work on individual species both in the field and in the laboratory, there are some aspects of the life cycles or behaviour which have not been resolved and the author has kept observations on a number of species which are common or locally common and over whose habits there is a question mark.

Oviposition

The method of oviposition varies: some Yorkshire species enter the water to deposit their eggs on stones, e.g. *Baetis rhodani*. Although this is well documented I have not found it easy to observe on large rivers, and the females do dip the abdomen while flying upstream. It has been suggested that the purpose is to moisten the eggs. (There is a parallel with a British caddis fly *Brachycentrus subnubilus* which dips but ovipositions under water.)

Baetis fuscatus hatches in huge numbers on the Wharfe and the Ure with a peak between the end of May and mid-June. It is estimated that 90% of the nymphs emerge during this period. The triggering factor appears to be a combination of light intensity, high barometric pressure, low water flow and light wind speed.

During the period of emergence, birds, fish and bats feed intensively upon both the nymphs and the winged adults. After swarming and mating the females fly upstream and oviposition by dipping in the surface film, usually in water 0.5 to 1 metre deep, but avoid 'broken water'. Although I have never seen winged adults of this species entering the water, other observers claim to have done so. It is possible that experiments with artificial streams may give rise to variations in behaviour.

Ephemera vulgata

In Yorkshire and elsewhere the eggs are deposited on warm days when there is very little wind. The usual time is during the afternoon but when the weather has been windy during the preceding days, followed by a calm day, very large numbers of females will leave the surrounding trees from as early as 7 a.m. and ovipositioning may continue throughout the day until evening. On such days swarms of males may be seen flying close to a marker; dam walls, buildings and dead trees are typical sites and are always close to the area where ovipositioning will take place. The same sites have been noted for over a period of 20 years.

The areas selected for ovipositioning are the same areas where the nymphs have passed the previous two years in their burrows. These areas follow the course of streams which were submerged when the reservoirs were built and through which currents of water flow from the connecting feeders. At normal water levels it is not possible to capture nymphs but in drought years it is possible to examine the sites and to count the number of burrows per square metre.

Downstream Drift and Migration

There is a downstream drift and some upstream movement of nymphs in rivers and streams. Some of this voluntary but very large numbers of invertebrates are washed out during periods of heavy flooding, particularly on the spate rivers; macrophytes are torn out and may be deposited to regenerate successfully downstream; in some severe floods more than 50% of the beds of aquatic mosses such as those found on the extended base of Harewood Bridge may be completely washed away and even be deposited in adjoining fields. The larvae and the over-wintering eggs of one of the most abundant species of mayfly *Ephemerella ignita* (the anglers' Blue-winged Olive) occur in millions in some of the beds of aquatic mosses, particularly *Eurhynchium rusciforme*. Those species whose eggs overwinter or whose larvae do not develop during the winter would therefore appear to be most vulnerable to loss of habitat. The adult mayflies whose nymphs are burrowers *(Ephemera)* do not travel very far from the point of emergence. The adults of the *Baetidae* and *Ephemerellidae* certainly do fly long distances (up to 1 km has been observed). In Yorkshire, this movement is mainly upstream, but downstream movement 'in huge numbers' in search of 'broken water' (indicating submerged vegetation) was described by the well known Test river keeper, A. J. Lunn. At Castley on the Wharfe and elsewhere, *E. ignita* has been known to leave the river and follow nearby roads for more than 1 km and oviposition on the damp road surface and upon parked motor vehicles. This behaviour has been noted towards dusk after rain, when the river is running high; no doubt the road surface with pools is mistaken for 'broken water' as observed by L. Magee over the period 1970-1990. Published references do suggest that upstream migration is minimal; the author's observation is that this is true for the species which are least vulnerable to disturbance, e.g. species with burrowing nymphs and those with stone-clinging nymphs.

Colonisation

Mayflies do colonise lakes but little has been published. They are known to have been

introduced successfully by anglers into man-made lakes such as fish ponds and gravel pits, and have also colonised lakes and ponds close to rivers and canals (*Cleon dipterum* can be found even in water butts). In 1991 *Ephemera vulgata* was seen emerging in a moorland pond which had been formed in 1989 by damming a small stream. This pond was 8 km from the nearest known colony and the owner was adamant that no insects or animals had been deliberately introduced. Eaton (1883-88) quotes examples of swarms seen at a height of 500 feet above the Rhine but most descriptions of mating flights in literature indicate a height of between 2 and 10m. Swarms of *Baetis rhodani* have been observed at a height of 15m, above tall trees adjacent to several Yorkshire rivers.

Conclusions

There have been few additions to the list of Yorkshire mayflies published by J. R. Dibb in the *Transactions* of the YNU in 1945 and it seems unlikely that many more will be added. Additional species found in Yorkshire in recent years are *Heptagenia fuscogrisea* and *Caenis luctuosa (moesta)*. There are however a number of species for which there are few Yorkshire records but which may prove to be more widespread since they occur in neighbouring vice-counties.

A Check List of Yorkshire Mayflies

	Anglers' Name	Status
1. *Siphlonurus armatus*	Summer Mayfly	Local, VC64. No recent records.
2. *Siphlonurus lacustris*	Summer Mayfly	Local, VC62, VC63, VC64, VC65 (Upland species).
3. *Ameletus inopinatus*		Local, VC62, VC64, VC65.
4. *Baetis rhodani*	Dark Olive	Widespread in Yorkshire in rivers.
5. *Baetis atrebatinus*	Dark Dun	Rare. R. Swale.
6. *Baetis fuscatus*	Pale Watery	Abundant on some rivers in all vice-counties.
7. *Baetis scambus*	Small Olive	Widespread in rivers in all vice-counties.
8. *Baetis vernus*	Medium Olive	In all vice-counties but less common than *B. scambus*.
9. *Baetis muticus*	Iron Blue	Widespread in rivers in all vice-counties.
10. *Centroptilum luteolum*	Little Sky Blue	In all vice-counties but not on all main river systems.
11. *Centroptilum pennulatum*	Blue-winged Pale Watery	Local. VC62. VC63, VC64, VC65.
12. *Cloeon dipterum*	Pond or Lake Olive	In unpolluted ponds and lakes with aquatic vegetation.
13. *Cloeon simile*	Pond or Lake Olive	Local, VC64, VC65.
14. *Procloeum bifidum*	Little Pale Blue	VC62, VC62, VC63, VC64, VC65.
15. *Rhithrogena semicolorata*	Yellow Upright	Widespread in stony bottomed streams.
16. *Heptagenia sulphurea*	Primrose Dun	Local, main rivers in VC64, VC65.

17. *Heptagenia fuscogrisea*	Brown May Dun	Only in R. Derwent, Driffield Beck and R. Hull.
18. *Heptagenia lateralis*	Dark Dun	In lakes and rivers, local, VC62, VC64, VC65.
19. *Ecdyonurus torrentis*	Brook Dun	In all vice-counties. Prefers stony bottomed streams.
20. *Ecdyonurus venosus*	March brown	Widespread in unpolluted stony bottomed streams.
21. *Ecdyonurus dispar*	August Dun	In all vice-counties. Prefers stony bottomed streams.
22. *Ecdyonurus insignis*	Large Green Dun	Local, R. Ribble, R. Wenning and R. Swale.
23. *Leptophlebia marginata*	Sepia Dun	Local, VC63, VC64 lakes and streams.
24. *Leptophlebia vespertina*	Claret Dun	Local, lakes and slow streams.
25. *Habbrophlebia fusca*	Ditch Dun	Slow streams with vegetation, VC61, VC62, VC64, VC65.
26. *Paraleptophlebia submarginata*	Turkey Brown	Small stony streams, VC62, VC64, VC65.
27. *Paraleptophlebia cincta*	Purple Dun	Small stony rivers, VC62, VC64, VC65.
28. *Ephemera vulgata*	Dark Mackerel	Morehall Reservoir VC63, Leeds/Liverpool Canal VC63 and VC64; reservoirs in VC64.
29. *Ephemera danica*	Greendrake	All vice-counties; lakes and rivers, chiefly slow-flowing.
30. *Ephemerella ignita*	Blue-Winged Olive	In fast flowing rivers in all vice-counties.
31. *Ephemerella notata*	Yellow Evening Dun	Similar habitat to last species but much more local, VC64, VC65.
32. *Brachycercus harrisella*		Local on Ouse tributaries: Wharfe, Swale, Ure, Nidd and Pocklington Canal. Maybe under-recorded.
33. *Caenis macrura*	Anglers' Curse	Very local. Aire, Wharfe and Ure.
34. *Caenis luctuosa*	Anglers' Curse	Local, VC62, VC63, VC64.
35. *Caenis horaria*	Anglers' Curse	Local, VC63, VC64.
36. *Caenis rivulorum*	Anglers' Curse	Stony streams. Local, VC64, VC65.

NOTE.

Very large areas of Yorkshire are underworked and some old records are dubious. The checklist is therefore merely a guide to the verified Yorkshire species. Distribution maps for all species are in preparation.

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BOOK REVIEWS

The Badger Man: memoirs of a biologist by **Ernest Neal**. Pp. x + 274. with 22 black and white photographs and 6 cartoons. 1994. Providence Press, Ely, Cambridgeshire. £13.95 paperback.

Ernest Neal is well known as the leading authority on the biology of our native badger. His reputation has been established through many years of study, publication of books and scientific papers, service on committees and advisory bodies and appearances on radio and television. This is the public image but only when reading his autobiography does one appreciate the much greater diversity of his contributions in what has been a rewarding life.

The son of a Baptist minister, Ernest (born in 1911) was the youngest of four children. While the family lived modestly, Ernest nevertheless experienced a diverse and rewarding childhood, being introduced to natural history through his father's interest in butterflies. Completion of a degree course at London University, while posing few academic

difficulties, did throw up a number of financial problems which were only resolved by taking up junior teaching positions, undertaking odd jobs and attending evening classes at Chelsea Polytechnic. Throughout his memoir comes through a burning enthusiasm for natural history, not only of butterflies but equally of all plants and animals whether terrestrial or marine. His badger interests were, in fact, not initiated until he was established in his first teaching post at Rendcombe College.

Ernest Neal's prime professional commitment was to school teaching, first at Rendcombe and then at Taunton, where he served as Head of Science, Housemaster and Deputy Head. His dedication, wisdom and sincere interest in his boys constantly emerges. Even with these considerable responsibilities his commitment to natural history could not be submerged. More than that, he has undertaken fundamental research on the biology of the badger, particularly its reproduction, social behaviour and status which has been the foundation for much further study. How stimulating it must have been for his students to have had such a teacher. Photography and the media were among his other interests and it is through his anecdotes and vignettes of various episodes that the events of the past, many in the early days of natural history broadcasting, come to life.

That Ernest Neal has lived a full and rewarding life bursts forth from this book. Teacher, author, scientist, administrator, photographer and broadcaster are among his many roles, while his geographical experience extends from Britain to much of Africa and Europe. His family connections, which feature prominently, have been deep and strong, initially through his parents and siblings and subsequently and for over fifty years through his wife Betty and their children. Equally strong is his religious commitment. He writes well, conveying his own enthusiasm, but is never assertive as to his own successes and contributions. The book is more than a good read, it is an example of considerable achievement (from time to time against a background of serious ill health) for which we are all the richer.

MJD

Flora Europaea. Volume 1: Psilotaceae to Platanaceae. Edited by **T. G. Tutin** ***et al.*** 2nd edition. Pp. xlvi + 581, including 5 maps. Cambridge University Press. 1993. £100.00.

The first volume of this prestigious work, hailed on its first publication 30 years ago as a model of its kind for international use, has now been thoroughly revised and considerably extended to include a larger number of taxa, each of which is described with admirable clarity and conciseness. The original highly satisfactory format and style have been retained. It will be noted that its subtitle has necessarily been changed to accommodate the interesting discovery in south-west Spain of a 'tropical and subtropical' psilophyte, *Psilotum nudum*.

All the useful features of the first edition are included, but the use of contrastingly coloured pages for easy cross-referencing of the Explanatory Notes and the Glossary of Technical Terms has been dropped, which is a pity: presumably the publishers felt that this was an unjustifiable luxury in an already unavoidably expensive volume.

Flora Europaea is sponsored by the Linnean Society of London and the preparation of this new edition of Volume 1 has been supervised by an editorial committee based in Britain and Ireland which has coordinated a mass of data from international sources, much of it via an impressive body of experts; the appendices, for example, provide biographical and bibliographical information on more than 1300 botanists and their publications.

Both editors and publishers are to be heartily congratulated on realising this monumental project, which will be enthusiastically welcomed throughout the botanical world. Sadly, however, it seems that at present some doubt hangs over the production of a revision of the remaining four volumes of this indispensable work.

MRDS

OTTERS (*LUTRA LUTRA* L.) AS SCAVENGERS: AN EXPERIMENT

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INTRODUCTION

Salmon *Salmo salar*, spawning in the upper reaches of the River Dee and its tributaries in north-east Scotland in November and December, provide a potentially large supply of food for otters, either as prey or carrion. Otters readily take salmon in the shallow water at the spawning redds (Carss *et al.* 1990), in addition to which many salmon carcases are available to scavengers from fish that die after spawning. Only 3-6% of salmon that have spawned return to spawn a second time (Mills 1986). Thus salmon carrion provides an abundant seasonal food supply along the Dee, amounting to as much as 36 kg. km^{-1} along the river bank (Hewson 1995). This paper describes scavenging by otters based on an experiment in which radio-tagged salmon carcases were provided to determine the extent to which otters scavenge when live fish are readily available.

STUDY AREAS

The study areas comprised 900 m of the Burn of Cattie from its junction with the river Dee, and 400m of the Beltie Burn, which joins the Dee 4.0 km downstream and 6.5 km downstream of the confluence of Dee and Cattie (Figure 1). Both are used by spawning salmon which travel several km further upstream to spawning redds.

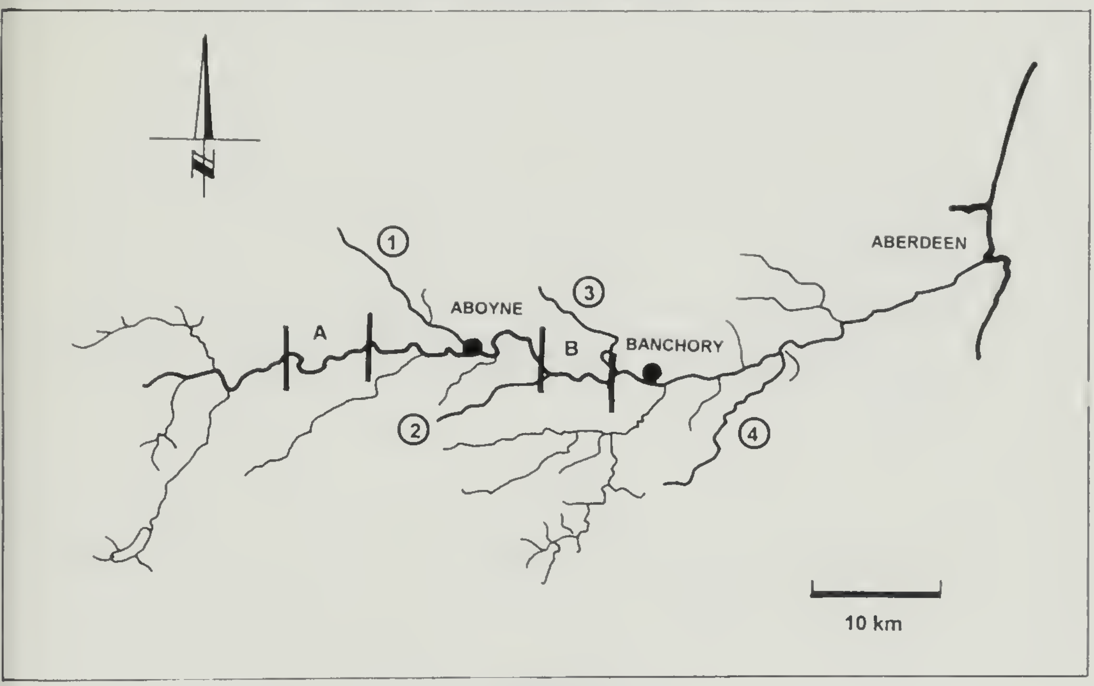

FIGURE 1
Study areas on River Dee: **A** Dinnet, **B** Blackhall. Streams used by spawning salmon: (1) Tarland, (2) Cattie, (3) Beltie, (4) Sheeoch.

The Cattie is 4-5m wide, and 0.3 –1.0m deep, with riffles and pools, the bottom sandy or gravel-covered. Alder *Alnus glutinosa* and birch *Betula* spp. line the banks and fallen branches obstruct the flow of the stream and cause salmon carcases to lodge in them.

The 400m of the Beltie burn is 3-4m wide, slow-moving and silt-bottomed. It is therefore unsuitable for spawning salmon which pass through to spawn in the upper reaches. The banks were steep and man-made during former drainage operations, and were

partially lined with willows *Salix* spp. Otters were common and fed largely upon brown trout *Salmo trutta* outside the spawning season of salmon when there was little other aquatic prey (Kruuk *et al.* 1993).

Other scavengers, which occurred on both study areas and might have benefited from salmon carcases landed by otters included mink *Mustela vison*, fox *Vulpes vulpes* and various scavenging birds, heron *Ardea cinerea*, carrion crow *Corvus corone*, and moorhen *Gallinula chloropus*. Great black-backed gulls *Larus marinus*, which regularly scavenge salmon carcases along the Dee, did not forage along the tributary burns.

Methods

Twenty-three female salmon carcases, intact except for the stomach and part of the snout, were fitted with radio transmitters (Hewson 1995). Between 24 November 1992 and 10 March 1993, 14 of these were placed, two at a time, in shallow backwaters in the Cattie and two in the Dee nearby. They were replaced when scavenged or washed away by spates.

Seven carcases were placed singly, and replaced when gone, on a small sandy spit at the water's edge on the Beltie which regularly showed tracks of otters, and where otters had scavenged carcases in an earlier study (Hewson 1995). The spit was too small to accommodate two salmon and the adjacent stream narrow and shallow.

Radio-tracking was carried at intervals of 1-3 days on the Cattie and 1-12 days on the Beltie.

The remains of salmon killed or scavenged by otters were generally found within 2m of the water with a trail through the vegetation from the water's edge and in some cases otter tracks in sand or mud. There was no attempt to conceal the carcase and otters did not seek secluded places to feed. Otters fed between the head and dorsal or belly fins of salmon carcases, sometimes biting through the spine or removing the carcase except for the head. Freshly killed fish showed blood and scattered scales.

Of the other scavengers of salmon carcases, crow and great black-backed gulls were seen feeding at some of the experimental carcases. Crows have difficulty in breaking into salmon carcases and generally do so at the anus or by making small pits 1-2cm in diameter and 1cm deep in rotting carcases. They remove the eyes from fresh carcases of various species often without further scavenging (Houston 1978, Hewson 1984, 1995). Great black-backed gulls tore large pieces from salmon carcases but left no diagnostic signs.

Mink fed where an otter had already broken into a salmon carcase, sometimes extending the area by feeding to a depth of *c.* 1cm below the skin, and also at the head between eye socket and snout.

Results

Scavenging by otters

Of the 16 radio-tagged carcases put into the Cattie and Dee six were washed away by spates (see below). Otters hauled out the remaining 10 and scavenged nine of them (Table 1). The tenth was scavenged by birds.

TABLE 1

Scavenging of salmon carcases placed in water (Cattie burn) or at water's edge (Beltie burn)

	Number of carcases				
	Put in	Removed by spates	Hauled out	Otter scavenged	Fate unknown or other scavenger
Cattie/Dee	16	6	10	9	1
Beltie	7	0	7	4	2

All the carcases were found within 2m of the water or in the stream or river. Within a three-week period three carcases had been taken 20-30m upstream where they were scavenged on boulders and at the water's edge. One of the two carcases in the Dee was scavenged at the water's edge, the other on a groyne 2m upstream of where it had been put in. Both were fully scavenged.

All seven carcases put out at the Beltie were moved by otters, which left tracks in the sand; they scavenged at least four of them (Table 1). They did not take carcases from the water to the nearest place on the bank as at Cattie presumably because the banks of the Beltie burn were steep and one bank was alongside a public road. Instead, salmon carcases were either taken to the mouth of a culvert beneath the road, 110m upstream from the spit where they had been placed, or to the far bank 95m downstream. Radios from two of the remaining three carcases were traced to the middle of an arable field 800m from the Beltie and a conifer plantation 1.0 km away respectively. They may have been taken there by foxes after otters had recovered them from the shallow water and silt which had covered them since they were put out. Foxes are known to remove salmon carcases from the bank before feeding on them (Cuthbert 1973, Hewson 1994).

Carcases moved by spates (Table 2) were washed into deeper water or lodged beneath driftwood. They were not scavenged by otters. Four of the six were moved out of the study area. One of these was found, thought to be scavenged by great black-backed gulls, 6 km downstream of the study area.

TABLE 2

Salmon carcases placed in Cattie burn and removed by spates

Date put in	Date of spate	Observations
13 Dec.	19 Dec.	Found 5 Feb.. not scavenged
13 Dec.	19 Dec.	not found in study area
19 Dec.	26 Dec.	lodged beneath driftwood
27 Dec.	5 Jan.	6 km downstream bird scavenged
27 Dec.	15 Jan.	in R. Dee, 11 Feb.
10 Jan.	15 Jan.	not found

TABLE 3

Salmon carcases moved by otters from Burn of Cattie

Time (days)	Initial weight (kg)	Amount scavenged by otters (kg)*	
2	2.04	1.36	fully scavenged
1	2.81	0.57	
10	2.67	2.10	fully scavenged
8	2.16	1.16	
3	1.96	>1.50	fully scavenged
12	3.07	1.53	
2	2.07	1.59	fully scavenged

* when found. Some carcases were further scavenged by otters later .

Otters fed substantially upon salmon carcases placed in the Cattie, some of which were hauled out and scavenged within three days (Table 3). Carss *et al* (1990) found that otters killing spawning salmon on the Burn of Sheeoch, another tributary of the Dee, took an average 975g as a single meal. These were larger fish than those used in the present study and feeding occurred chiefly behind the pectoral fins. On the smaller carcases used in this study scavenging occurred in the same area but extended further towards the tail; in fully scavenged carcases only the skull, vertebrae, tail and skin, weighing together about 0.6 kg, remained.

Amounts scavenged by otters at Cattie (mean 1.40kg, range 0.57-2.10) were larger than at Sheeoch but fell within the same range, 0.29-2.08kg. At Sheeoch otters obtained most of their daily food requirements by catching one salmon from those readily available on the spawning redds. There was no spawning redd within the Cattie and Beltie study areas and with food less readily available otters ate more from each carcase and returned to some of them for further scavenging. If fully scavenged carcases at Beltie (Table 4) were assumed to weigh 0.6kg the average amount eaten by otters there, 1.35kg, was similar to Cattie.

TABLE 4
Salmon carcases moved by otters at Beltie

Time (days)	Initial weight (kg)	Amount scavenged by otters (kg)*
7	2.53	fully scavenged later
10-18	1.08	scavenged by fox later
3	2.44	fully scavenged later
2	1.84	0.97
1	2.70	0.64
1	1.73	scavenged by fox later
12-17	2.12	not found

* when found: some carcases were scavenged by otters later.

Live prey of otters along the Cattie
Between 29 Nov. 92 and 5 Feb. 93 the remains of nine salmon were found along the Cattie. One, a small female on a gravel spit, was scavenged by a heron which was flushed from the carcase. The remaining eight had been put on the bank by otters (Table 5). Seven had been killed (fresh blood). The eighth was a salmon seen dead in the water two days earlier. From these salmon a full meal (*c.* 1.4kg) or more had been taken; only the head remained of two fish. A similar amount (1.3kg) was scavenged subsequently, principally by otters.

The remains of the heaviest fish killed by an otter, from which a meal had been taken, weighed 4.9kg, indicating a live weight of around 6 kg, near the upper limit for salmon brought ashore by otters. (The average weight of a female otter is 7kg (Chanin (1991)).

Other scavengers of salmon carcases
Otters help other scavenging mammals and birds by removing salmon to the bank and leaving them partly eaten. Six of the seven salmon killed (and one scavenged) by otters along the Cattie provided food for other scavengers (Table 5). Crows were involved in all cases, removing eyes or making small pits in flesh. A great black-backed gull scavenged a carcase on which mink and crows had already fed, but mink scavenged only one carcase and great black-backed gulls two.

The experimental carcases hauled out by otters on Cattie also provided food for other scavengers. Mink scavenged three, taking between 71g and 284g per day, when more than one mink may have been involved. Crows removed eyes from four carcases and, during a period of snow-lie, fed upon one which had lain on`the stream bank for 83 days. Tracks and droppings indicated that crows had fed along with mink at three carcases.

Scavenging of salmon carcases at the Beltie by foxes has already been discussed. On the Sheeoch, Cuthbert (1973) found substantial scavenging of dead salmon by badgers *Meles meles* and foxes, both of which removed carcases from the stream bank.

The amounts taken by scavengers other than otters were usually small and there was no evidence of competition for salmon carrion between otters and other bird or mammal scavengers (Hewson 1995, this study).

TABLE 5

Feeding on salmon killed (and one scavenged) by otters along Cattie
29 Nov. 92 to 5 Feb. 93

Date	Killed or scavenged	Weight (kg) when found	Subsequent scavenger	Amount eaten later (kg)
29 Nov	scavenged	2.36	otter, crow	1.33
1 Dec	killed	4.90	mink, crow, gull	–
12 Dec	killed	3.80	crow	–
28 Dec	killed	2.58	otter, crow	1.28
9 Jan	killed	head only	crow	–
19 Jan	killed	1.28	otter, crow, gull?	0.89
19 Jan	killed	2.16	otter, crow	1.73
5 Feb	killed	head only	none	–

Gull refers to great black-backed gull.

Discussion

Salmon, as prey or carrion, are clearly important to otters during the spawning season (Hewson 1995). On a 7.5 km stretch of the Dee (B on Fig. 1) the salmon carcases found during December and early January could have provided the entire food supply of one or two otters taking only a single meal from each carcase. However, the salmon carcases on a 9 km stretch 21 km upstream (A), with a more rapid flow and few tributaries used by spawning salmon, would not have sustained an otter even if it had scavenged them fully (Hewson 1995).

This study shows that otters readily take salmon carrion even when live fish are available and easily taken after spawning. Otters returned to feed on salmon they had killed and fed upon earlier, and then ate amounts equivalent to the average otter's meal as described by Carss *et al* (1990). They also ate similar amounts of carrion from the carcases provided experimentally.

A tentative estimate of the food of otters on the Cattie during the study indicates that salmon carrion may have been their major food. Captive otters when hungry took dead fish in preference to live ones and slow-moving fish more readily than faster ones (Erlinge 1968). Wild otters presumably find salmon which have spawned (kelts), slow-moving in the backwaters which they frequent, an easy prey. Similarly, dead salmon lying in shallow water provide an easy source of food. Outside their spawning season large salmon are not a usual food of otters (Kruuk *et al.* 1993) although present in the Dee as fresh-run fish from February onwards, presumably because these are more difficult to catch than smaller prey.

In Ireland, O'Sullivan *et al* (1992) record sporadic otter scavenging of brown trout *Salmo trutta* L., sheep, cooked shrimps, *Crangon vulgaris* L. and domestic geese and fowls. Food remains on islands frequented by otters at Loch Park in north-east Scotland included brown hare *Lepus europeaus*, mallard *Anas platyrhynchos*, moorhen, woodpigeon *Columba palumbus* and pheasant *Phasianus colchicus*, all of which were probably scavenged rather than killed (Hewson 1973).

Scavenging of salmon carcases during the spawning season provides a substantial part of the otter's diet. At other times otters scavenge sporadically.

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I am grateful to Anneke Stolte for help in the field, to Dr H. Kruuk for helpful discussions, to J. Morris, (I.T.E. Banchory) for technical assistance, and to landowners on whose ground I worked. The Vincent Wildlife Trust made a grant towards the cost of the work, and the Freshwater Fisheries Laboratory, Pitlochry, provided the salmon carcases. G. Woodroffe made helpful comments on earlier drafts.

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BOOK REVIEW

Flora of Radnorshire by **R. G. Woods.** Pp. xiii + 292, together with 9 pages of colour plates. National Museum of Wales, in association with the Bentham-Moxon Trust, 1993. £28.00 hardback.

This work maintains the traditionally high standards of county Floras and is a testimony to Ray Woods' detailed researches in mid-Wales over the past twenty years. Radnorshire is only one of several counties whose botany he has extensively explored, covering not only its vascular plants, but also its cryptogams; his ecological and conservation interests are also evident in this Flora.

Chapters are provided on the county's physical environment, plant communities (including a conspectus of their phytosociological classification), biogeography, changing flora, conservation and history of plant recording. The main body of the text provides ecological notes and locality details (maps on a tetrad basis given for the more widespread species) of flowering plants, ferns, mosses, liverworts and lichens; shorter sections deal with algae and cyanobacteria, and rust and smut fungi.

The volume is well produced, the text being admirably supported by maps, tables, line drawings and colour photographs of habitats. Thanks to the generosity of its several sponsors, the Flora is extremely reasonably priced.

MRDS

ACULEATE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF BLAXTON COMMON IN WATSONIAN YORKSHIRE WITH THE INTRODUCTION OF A NEW NATIONAL QUALITY SCORING SYSTEM

MICHAEL E. ARCHER

Blaxton Common has been found to be an excellent locality for aculeate wasps and bees, having 123 recorded species, six species of national importance and ten species of regional significance. The Common, an area of about 150ha, is situated to the north-east of Blaxton, near Doncaster (VC63, SE6901). The region has sandy acid soils worked by the sand and gravel extraction industry. After sand extraction, dry open horizontal sand and small sandy clifflets are left. Vegetation has invaded the open spaces, leading to the development of birch and oak woodland. Sheltered by the woodland the open areas become important nesting and foraging resources for the aculeate wasps and bees. Continued growth of the birch and oak will eventually shade out the open areas but at present many open areas are present.

Between 1980 and 1993, 17 visits were made to a sample area, about 25ha, of Blaxton Common along either side of the road from Finningly to Wroot. These visits were distributed throughout the year as follows: April (2 visits), May (4), June (3), July (3), August (3), September (2). During these three-hour visits all species of aculeate wasps and bees seen were recorded (Archer sample) and usually collected with a hand net for identification. In addition, I have had access to a small number of records from H. H. Corbett (June 1918), E. W. Aubrook (June 1969) and P. Skidmore (April 1967), a larger number of records from J. D. Coldwell (August 1991) and J. T. Burn (1972-78), to whom I am most grateful. In the following account biological names are according to Kloet and Hincks (1978).

RESULTS

Species present at Blaxton Common

At the family level, Table 1 shows the taxonomic distribution. The 122 recorded species represent about 46% of the aculeate wasps and bees recorded from Watsonian Yorkshire. In addition, J. T. Burn recorded the dryinid wasp *Anteon jurineanum* during May 1980.

The Archer sample of solitary wasps and bees consists of 315 records derived from 91 species (Table 2). Fifty-eight species (63.7%) were recorded on one, two or three days (unusual species) while the other 33 species (36.3%) were recorded on from four to 15 days (common species) (Table 3). Solitary bee species are more equally represented in the common (21 species) and unusual (27) groups compared with the wasp species which are represented more in the unusual (31) than the common (12) groups of species. Thus solitary wasps species would seem to be more difficult to find than solitary bee species. With 29 species (31.9%) only being found on one visit, the recording of further species is very likely.

A further eighteen solitary species have been recorded as follows: *Dipogon subintermedius* (=*D. nitidus*), *Anoplius nigerrimus*, *Ancistrocerus gazella*, *Tachysphex unicolor*, *Trypoxylon attenuatum*, *Crabro peltarius*, *Crossocerus cetratus*, *C. megacephalus*, *Ectemnius cavifrons*, *E. cephalotes*, *Stigmus solskyi*, *Pemphredon inornatus*, *Diodontus luperus*, *Nysson dimidiatus*, *N. spinosus*, *N. trimaculatus*, *Argogorytes mystaceus*, *Andrena cineraria*. Seventeen of these 18 species not found in the Archer sample are wasps species, indicating again the smaller probability of finding the wasp compared with the bee species.

The following ant, social wasp, and bee species have been recorded: Formicidae: *Myrmica ruginodes*, *Formica fusca*, *Lasius niger*; Vespidae: *Dolichovespula sylvestris*, *Vespula rufa*, *Paravespula germanica*, *P. vulgaris*; Apidae: *Bombus lucorum*, *B. terrestris*,

B. lapidarius, *B. pratorum*, *B. hortorum*, *B. pascuorum*, *Psithyrus bohemicus*, *P. vestalis*, *Apis mellifera*.

SEASONAL PROGRESSION OF SOLITARY SPECIES

From the Archer sample the solitary wasp species were only recorded during the summer months (Table 4). August was the most productive month for the number of species and individuals, and June, the month when the solitary wasp species first emerged, the best month for recording new specics. The subterranean nesting species of the open sandy areas were very evident including the spider-hunting *Pompilus cinereus*, the caterpillar-hunting sand-wasp *Ammophila sabulosa*, the fly-hunting *Crossocerus quadrimaculatus*, the grasshopper-hunting *Tachysphex pompiliformis* and *Evagetes crassicornis* which is a cleptoparasite on other spider-hunting wasps.

TABLE 1

The number of specics of aculeate wasps and bees rccordcd from Blaxton Common

	No. species
Solitary wasps	
Chrysididae	4
Mutillidae	1
Pompilidae	12
Eumenidae	3
Sphecidae	40
Total solitary wasps	60
Solitary bees	
Colletidae	6
Andrenidae	17
Halictidae	15
Megachilidae	3
Anthophoridae	8
Total solitary bees	49
Total solitary wasps & bees	109
Social wasps & bees	
Vespidae	4
Apidae	9
Total social wasps & bees	13

TABLE 2

The number of records and species of solitary wasps and bees rccordcd from Blaxton Common in thc Archer samplc

Family	No. species	No. rccords
Chrysididae	4	11
Mutillidae	1	4
Pompilidae	10	36
Eumenidac	2	2
Sphecidac	26	65
Collectidae	6	8
Andrcnidae	16	94
Halictidac	15	62
Mcgachilidac	3	6
Anthophoridae	8	27

TABLE 3
The number of days on which each species of solitary wasp and bee was recorded at Blaxton Common in the Archer sample

No. records	No. days	Species	No. species
29	1	*Chrysis angustula, Priocnemis schioedtei, Ancistrocerus parietinus, A. trifasciatus, Trypoxylon clavicerum, Crabro cribrarius**, *Crossocerus tarsatus, C. nigritus, Psen lutarius, Psenulus pallipes, Pemphredon lethifer, Diodontus minutus**, *D. tristis**, *Passaloecus gracilis, P. singularis, Gorytes quadrifasciatus, G. tumidus, Colletes daviesanus, C. succinctus**, *Hylaeus communis, H. confusus, H.brevicornis, Andrena angustior, A. barbilabris**, *Halictus rubicundus, H. tumulorum, Lasioglossum fratellum, L. punctatissimum, Megachile circumcincta.*	29
34	2	*Hedychridium ardens**, *Arachnospila anceps, A. trivalis, Anoplius concinnus, Episyron rufipes, Trypoxylon figulus, Crossocerus palmipes, C. wesmaeli, Psen dahlbomi, Pemphredon lugubris, Andrena saundersella, A. varians, Lasioglossum nitidiusculum, Megachile versicolor, Nomada fabriciana, N. ruficornis, N. rufipes**.	17
36	3	*Chrysis impressa, Priocnemis exaltata, Arachnospila spissa, Ectemnius continuus, Colletes fodiens, Andrena denticulata**, *A. praecox, Lasiogalossum leucopum, Sphecodes gibbus, Megachile willughbiella, Nomada flavoguttata, Epeolus variegatus.*	12
36	4	*Myrmosa atra, Anoplius viaticus**, *Crossocerus ovalis, Entomognathus brevis, Oxybelus uniglumis**, *Mellinus arvensis**, *Lasioglossum leucozonium, Sphecodes puncticeps, Nomada goodeniana.*	9
35	5	*Trichrysis cyanea, Andrena clarkella**, *A. fulva, A. tibialis, Lasioglossum rufitarse, L. villosulum, Nomada leucophthalma**.	7
18	6	*Lasioglossum calceatum, Sphecodes pellucidus**, *Nomada marshamella.*	3
7	7	*Tachysphex pompiliformis**.	1
48	8	*Evagetes crassicornis, Crossocerus quadrimaculatus, Ammophila sabulosa**, *Andrena chrysosceles, A. scotica, A. subopaca.*	6
36	9	*Pompilus cinereus**. *Andrena haemorrhoa, A. nigroaenea, Sphecodes monilicornis.*	4
10	10	*Andrena bicolor.*	1
11	11	*Sphecodes fasciatus.*	1
15	15	*Andrena minutula.*	1

*Local species in Watsonian Yorkshire.

From the Archer sample, the solitary bee species were recorded during the spring and summer months, being more frequent during the spring months (Table 4). May (for the

spring species) and August (for the summer species) were the most productive months for the number of species and individuals. The number of new species was most frequent during the first month of emergence: April for the spring species and June for the summer species. Typical spring species were the mining bees, *Andrena*, with their cleptoparasites, *Nomada*, e.g. *A. haemorrhoa* with *N. ruficornis* and *A. nigroaenea* with *N. goodeniana*. Typical summer species were the mining bees, e.g. *Colletes fodiens* with its cleptoparasite *Epeolus variegatus*, *Andrena denticulata* with *Nomada rufipes*, *Lasioglossum villosulum* with *Sphecodes puncticeps* and the aerial nesting *Megachile willughbiella*. Some bee species were found in the spring and the summer having passed through two generations, e.g. *Andrena minutula* with *Nomada flavoguttata*, *A. bicolor* with *N. fabriciana* and *Lasioglossum calceatum* with *Sphecodes monilicornis*.

TABLE 4
The number of species, new species and individuals of solitary wasps and bees recorded per month at Blaxton Common from the Archer sample

	April	May	June	July	August	September
Wasps						
No. species	0	0	19	20	32	7
No. new species	0	0	19	9	15	0
No. individuals	0	0	28	31	50	9
Bees						
No. species	22	24	21	11	17	13
No. new species	22	6	8	4	6	2
No. individuals	32	56	32	24	31	22

Quality Assessment of Solitary Species

Six species are nationally scarce species (Falk, 1991). One species, *Andrena tibialis*, which is a category A scarce species, reaches the northern boundary of its British distribution in Watsonian Yorkshire. The other five species, which are category B scarce species, are either at the northern boundary of their distribution (*Priocnemis schioedtei*, *Nysson trimaculatus*, *Andrena varians*) or are more widespread in Britain (*Crossocerus palmipes*, *Nysson dimidiatus*). No nationally rare species (Falk, 1991) have been found.

Ten species are rare in the context of Watsonian Yorkshire (Archer, 1993) (*Episyron rufipes*, *Tachysphex unicolor*, *Crossocerus palmipes*, *Psen lutarius*, *Diodontus luperus*, *Nysson dimidiatus*, *N. trimaculatus*, *Hylaeus brevicornis*, *Andrena tibialis*, *Sphecodes puncticeps*).

There are 27 species of solitary wasps and bees, which although not rare in Watsonian Yorkshire, have a local distribution, being more or less restricted to sandy habitats (Archer, 1994a). Eighteen of these local species are found at Blaxton Common and except for *C. peltarius* are indicated in Table 3.

The 109 species of solitary wasps and bees can be considered to have a common, frequent, occasional or rare status in Watsonian Yorkshire (Archer, 1993) (Table 5). By giving each species a score depending on the above statuses, including a higher score for the nationally scarce species, a quality score of 341 can be calculated (Table 6). Dividing the quality score by the 109 species gives a species quality score of 3.1.

Ball (1992) proposed a status category scheme for invertebrates in a national context (Table 7). Since such a status coding has not previously been applied solely to the aculeate Hymenoptera of a particular locality the following proposals can be made. The nationally rare and scarce statuses will remain the same as previously considered. The regionally notable species are equated with the regionally rare species. Ball (1993, *pers. comm.*) defined the term "local" as a species either restricted to a particular habitat type or to a particular geographical area, or to widespread species which are intermediate in status

between common and scarce species. At present there is no objective way of assigning a common or local status to the species of the British aculeate Hymenoptera. From personal experience I have therefore assigned common or local status based upon abundance and distribution within England and Wales. Ireland was excluded as little information is available on Irish distributions, as were the Channel Islands, since their fauna relates more to France than to the British Isles, and Scotland, because its cooler climate has a profound effect in reducing the diversity of aculeate Hymenoptera. Using the Ball national status scheme a quality score of 209 and a species quality score of 1.9 can be calculated (Table 7).

TABLE 5

The regional coding of the 109 species of solitary wasps and bees recorded from Blaxton Common

Status	No. species
Common	42
Frequent	34
Occasional	23
Rare	10

TABLE 6

The regional quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Common	1	41	41
Frequent	2	34	68
Occasional	4	22	88
Rare	8	6	48
Nationally Scarce	16	6	96

TABLE 7

The Ball national quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Common	1	65	65
Local	2	32	64
Regionally notable	4	6	24
Scarce B	8	5	40
Scarce A	16	1	16

Two objections can be raised against the Ball national status scheme. Firstly, since regionally notable species are unknown for many parts of England, Ball's scheme cannot be applied. Secondly logically a national scheme should give a species status based upon that species' importance in a national and larger geographical setting but not in a smaller or regional distribution.

To overcome the above objections I suggest the following scheme in which the statuses of "Common" "Local" and "Regionally Notable" of Ball are replaced by: "Universal" "Widespread" and "Restricted". These new statuses are assigned from personal experience of a species' abundance and distribution within England and Wales. Universal species would be common species found throughout England and Wales, which usually extend into

Scotland. Widespread species would be found in about three-quarters of England and Wales, usually with a distribution in Wales, southern and midland England or in northern and western England and Wales. Widespread species also may be found throughout England and Wales but either with a local distribution or a less than common abundance. Restricted species would mainly be found in about one-half of England and Wales, usually confined to southern England and East Anglia. Using this new national status scheme, a quality score of 205 (Table 8) and a species quality score of 1.9 can be calculated for Blaxton Common.

Cleptoparasitic Load

The cleptoparasitc load (CL) is the percentage of aculeate species that are cleptoparasites on other host aculeates (Table 9). At Blaxton Common the CL for the species of solitary bees is higher than the CL for the species of solitary wasps.

Aerial Nester Frequency

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nests are often in old beetle burrows in dead wood or the central cavities of stems such as those of bramble. Subterranean nesters nest in the soil, usually in burrows dug by themselves but sometimes in crevices or pre-formed burrows (Table 10). The AF for the species of solitary wasps is higher than the AF for the species of solitary bees at Blaxton Common.

TABLE 8

The Archer national quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Universal	1	59	59
Widespread	2	43	86
Restricted	4	1	4
Scarce B	8	5	40
Scarce A	16	1	16

TABLE 9

The relative frequency of the cleptoparasitic species among the solitary wasps and bees from Blaxton Common

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic Load CL=100*C/(H+C)
Solitary Wasps	51	9	15.0
Solitary Bees	36	13	26.5

TABLE 10

The nesting habits of the host solitary wasp and bee species from Blaxton Common

	No. aerial nesters (A)	No. subterranean nesters (B)	Aerial nester frequency AF=100*A/(A+S)
Solitary Wasps	22	29	43.1
Solitary Bees	5	31	13.9

TABLE 11

A comparison of the quality scores of sandy habitats in Watsonian Yorkshire and elsewhere in England based on the species of solitary wasps and bees.

	Sherwood Forest	Pre-coniferized Allerthorpe Common	Charnwood Forest	Strensall Common	Coniferized Allerthorpe Common	Pompocali	Blaxton Common	Risby Warren	Swincarr Plantation	Skipwith Common
Area (ha)	390	2030	11,650	690	2030	1.7	150	170	0.05	312
No. species	100	129	147	91	75	51	109	63	35	69
Regional scheme										
Quality score	–	514	–	289	212	136	341	–	74	149
Species quality score	–	4.0	–	3.2	2.8	2.7	3.1	–	2.1	2.2
Ball's national scheme										
Quality score	290*	381	402**	213	167	112	209	119*	57	105
Species quality	2.9	3.0	2.7	2.3	2.2	2.2	1.9	1.9	1.6	1.5
Archer's national scheme										
Quality score	296	379	402	225	175	115	202	114	62	109
Species quality score	3.0	2.9	2.7	2.5	2.3	2.3	1.9	1.8	1.8	1.6

* Regional notable species based on Watsonian Yorkshire
** Regional notable species based on Archer (1990)

DISCUSSION

Quality Assessment

The regional and national status schemes of Ball and Archer can be applied to other sandy localities in Watsonian Yorkshire (Archer, 1984, 1985, 1988, 1989, 1992b), Lincolnshire (Risby Warren, Archer, 1994b), Nottinghamshire (Sherwood Forest, Archer, in press) and Leicestershire (Charnwood Forest, Archer, 1992a) (Table 11). The sandy habitats vary greatly in size from the sand pit at Swincarr Plantation to the eroded Precambian mountain range of Charnwood Forest. The number of species of aculeate wasps and bees varies from 35 species at Swincarr Plantation to 147 species at Charnwood Forest.

The quality and species quality scores of the Ball and Archer national status schemes for each locality are of a very similar or even of the same value (Table 11). Blaxton Common on its species quality score is ranked seventh on the Archer scheme and equal seventh with Risby Warren on the Ball scheme out of the ten data sets. Both schemes would seem suitable as a national status scheme but the Archer scheme is preferred for reasons given earlier.

For the seven Yorkshire localities the regional and Archer national species qualities scores show a significant linear positive relationship (correlation coefficient, $r = 0.87$, $p<0.02$). Similarly the regional and Archer national quality scores show a highly significant linear positive relationship ($r = 0.98$, $p<0.001$). At present these relationships cannot be explored outside Watsonian Yorkshire as regional statuses for other parts of England are not yet available. The regional species quality and quality scores are higher for each locality than the Archer national scores (Table 11) because there are four, rather than three, statuses before the national scarce species (Tables 6, 8).

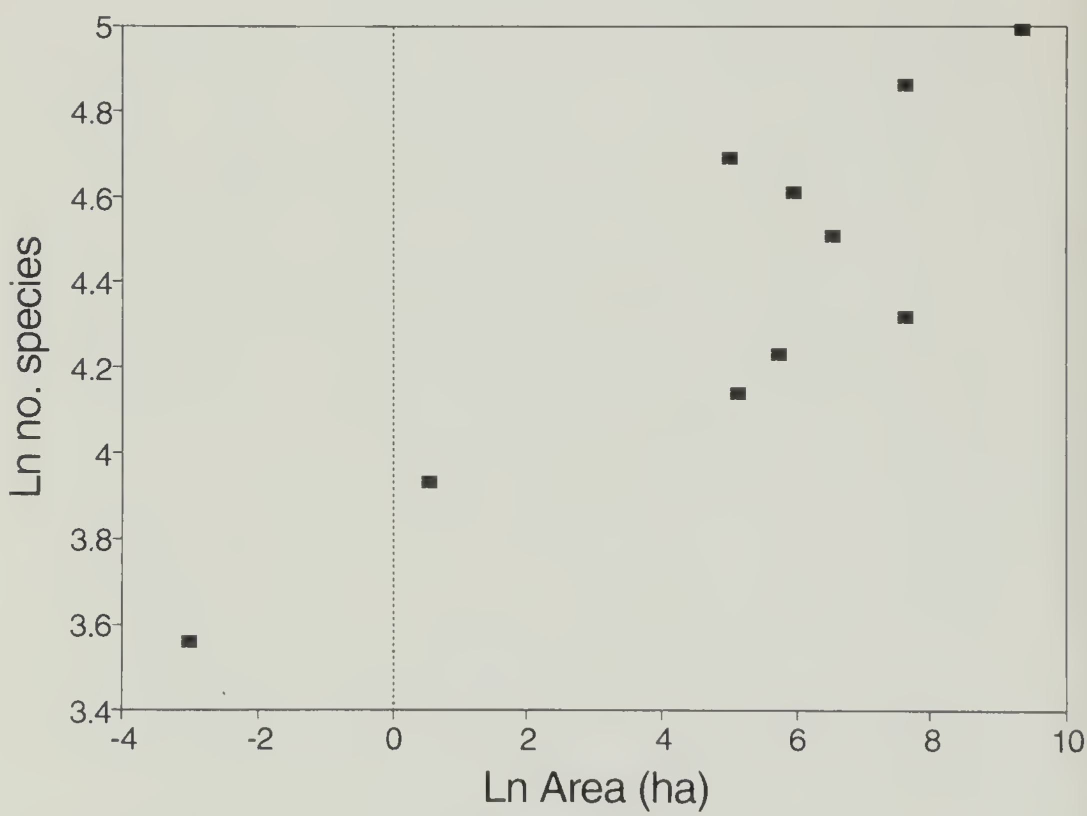

FIGURE 1

The Ln number of species versus Ln area (ha) of the species of solitary wasps and bees recorded from sandy habitats in Watsonian Yorkshire and elsewhere in England.

For each locality the Archer national quality score shows a highly significant linear positive relationship with the number of species ($r = 0.95$, $p=0.001$). This relationship is a reflection of a species-area relationship. Thus the larger the area of the locality the more species are present, including an increased chance of nationally scarce and rare species being found. A plot of Ln number of species versus Ln area in hectares gives a highly significant relationship ($r = 0.87$, $p=0.001$) (Figure 1). Removing the data for coniferized Allerthorpe Common, which is a damaged habitat (Archer, 1989), increases the significance of the species-area relationship ($r = 0.92$, $p<0.001$) and gives the species-area equation: $LnS = 3.85 + 0.11\ LnA$, where S = number of species and A = area in hectares.

Cleptoparasitic Load & Aerial Nester Frequency

The wasp and bee cleptoparasitic loads are similar to values from other sandy localities (Archer, 1992b, 1993).

Likewise, the wasp and bee aerial nester frequencies are similar to lowland heaths such as pre-coniferised Allerthorpe and Strensall Commons (Archer, 1992b).

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BOOK REVIEWS

Aliens in the British Isles by **R. Gwynn Ellis**. British Plant Life no. 2. National Museum of Wales, Cardiff. 1993. £3.50.

This is another well illustrated booklet from the National Museum of Wales, which provides an introduction to some 40 species of alien plants which have been deliberately and/or accidentally introduced into the British Isles. The species cover a wide range from bulbs and herbaceous plants to shrubs and trees; both old (Corn Marigold) and new (New Zealand Pigmyweed) arrivals to the country are featured. The effects of some of the more invasive species, such as Rhododendron and Japanese Knotweed, are dealt with in the introductory text. Each plant (given its English, Welsh and scientific names) is described briefly and its British and world distributions provided by maps, the latter showing the plant's origin. It is to be hoped that further books in this series will be produced. Recommended both for beginners and the more serious botanist.

DRG

Drought follows the Plow: cultivating marginal areas edited by **M. H. Glantz.** Pp. viii + 197 including 38 figures. Cambridge University Press. 1994. £25.00 hardback, £12.95 paperback.

Human interference is all too often detrimental to our environment. Changes in land use ostensibly intended to improve human welfare, but often initiated through ignorance, are particularly insidious. A century ago a belief that ploughing, cultivation and tree planting could increase local rainfall, gave rise to the phrase 'rain follows the plough'. In fact the reverse is the case, especially in marginal lands where the risk of crop failure in any given year is relatively high. Here climatic variability encourages exploitation in periods of adequate rain, to be followed by disaster in dry periods. The result is environmental degradation, destruction of ecosystems, or even complete desertification.

This little book presents background information on marginal lands and gives case histories of their abuse from the Great Plains of N. America, N.E. Brazil, Australia, the 'virgin lands' of the former Soviet Union, and half a dozen areas of Africa. All are depressingly similar. Vast areas are involved: between 1954 and 1958 an area three times that of Britain was put into cultivation in the virgin lands scheme on the basis of experience in the better-watered Ukraine and of wishful thinking. Furthermore, some areas were already being used sensibly by pastoralists. Elsewhere, inappropriate and destructive technology contributed to the damage of land that was simply unsuited to the kinds of exploitation envisaged, and everywhere in developing countries rapid increases in human populations exacerbate the problems. African National Parks, perhaps best exploited by game animals, are also threatened. Their salvation may be to share the profits of tourism with local populations. In the Great Plains of N. America reversion of some areas to grassland populated by Bison may be the best solution.

Climatic variability in marginal lands is now well known but is regularly ignored by 'developers' and governments who could benefit more from the knowledge of ecologists and naturalists than is often the case. Lessons are also to be learned from 'backward' societies which have often accommodated themselves to nature and its rhythm. Anyone concerned with the careful management of our planet, not least policy makers, could read this book with profit and should keep in mind that global warming may impose additional stress on these fragile areas in the future.

GF

SOME RECORDS OF FEATHER MITES (ACARI: ASTIGMATA) IN YORKSHIRE

BARRY NATTRESS
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INTRODUCTION

Feather mites are members of the Acari, belonging to the group Astigmata. They have neither stigmata or trachea. The gnathosoma is clearly visible from above. The idiosoma is divided by the sejugal furrow into the anterior propodosoma and the posterior hysterosoma. Both the propodosoma and the hysterosoma bear sclerotized shields. The coxa are fused to the ventral surface of the idiosoma forming apodemata. The anus is ventral and, in the male, is usually flanked by the adanal discs. The legs generally comprise six free segments, and include the ambulacrum – a bell-shaped sucker typically surrounding a very small claw.

The only recorded studies of feather mites in northern England were undertaken by the Rev. John Edward Hull (1863-1960), who completed his studies in Northumberland and Durham (Hull 1934), and by Mr Harold (Harry) Britten (1870-1954), who worked only in Lancashire and Cheshire. There are no records of feather mites in Yorkshire.

MATERIALS AND METHODS

In order to collect the mites from bird feathers, the primaries, secondaries and retrices were removed and examined individually under a stereo microscope. Mites were then transferred, using a fine brush, into a drop of mountant on a slide and covered with a cover-slip. The mountant used was polyvinyl lactophenol which had the benefit of clearing the mites to allow a thorough examination. The remaining feathers were then examined *in situ* using the stereo microscope and the resulting mites mounted as before. Once the mites had cleared they were identified using a compound microscope with magnifications ranging from 100x to 400x (and very occasionally 1000x).

HOST BIRDS AND COLLECTION LOCALITIES

A. Bilton in Ainsty, SE4749, Swallow *Hirundo rustica* Linnaeus.
B. Bilton in Ainsty, SE4749, Magpie *Pica pica* (Linnaeus).
C. Bramham, Headley Hall Farm, SE4441, House Sparrow *Passer domesticus* (Linnaeus).
D Castleford, SE4325, Collared Dove *Streptopelia decaocto* Frivaldszky.
E. Chapel Allerton, Leeds, SE2937, Great Tit *Parus major* Linnaeus.
F. Drighlington, SE2228, House Sparrow *Passer domesticus* (Linnaeus).
G. Huddlestone Wood, Sherburn in Elmet. SE4633, Pheasant *Phasianus colchicus* Linnaeus.
H. Malham, SD8966, Rook *Corvus frugilegus* Linnaeus.
I Mickletown Ings, SE3927, Mute Swan *Cygnus olor* Gmelin.
J. Swinsty Reservoir, Washburn Valley, SE1952, Jay *Garrulus glandarius* (Linnaeus).
K. West Ardsley, SE2724, Blackbird *Turdus merula* Linnaeus.
L. Willow Garth, Knottingley, SE5124, Starling *Sturnus vulgaris* Linnaeus.

SPECIES LIST – ACARI

Family Analgesidae	
Analgopsis mucronatus (Buchholz)	E.
Analgopsis tridentulatus (Haller)	L.
Megninia ginglymura (Mégnin) (Gaud, Atyeo & Barre 1985)	G.
Diplaegidia columbae (Buchholz)	D.
Family Alloptidae	
Trouessartia rosterii (Berlese) (Santana 1976)	L.

Family Dermoglyphidae	
Falculifer rostratus (Buchholz) (Dubinin 1951)	D.
Family Proctophyllodidae	
Brephosceles anatina Dubinin (Peterson 1971)	I.
Proctophyllodes corvorum Vitzhum (Atyeo & Braasch 1966)	H.
Proctophyllodes glandarinus (Koch)	J.
Proctophyllodes musicus Vitzhum	K.
Proctophyllodes picae (Koch)	B.
Proctophyllodes stylifer (Buchholz)	E.
Proctophyllodes troncatus Robin	C; F.
Montesauria cylindrica (Robin) (Park and Atyeo 1971)	B.
Family Pterolichidae	
Pteronyssoides obscurus (Berlese)	A.
Pteronyssoides truncatus (Trouessart)	L.
Gabucinia delibata (Robin)	H.

ACKNOWLEDGEMENTS

I would like to thank Dr Anne Baker and Mr Colin Howes for checking for Yorkshire records; Dr Sandy Baker for his continued help and encouragement; Mr Mike Smith for his help in the laboratory in preparing specimens; Mr C. W. Pettitt of Manchester Museum for access to the Britten collection of mites and the many friends who assisted by collecting the avian specimens.

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A SUB-FOSSIL RECORD OF *POMATIS ELEGANS* (MÜLLER), A MOLLUSC PREVIOUSLY UNRECORDED IN THE EAST RIDING OF YORKSHIRE

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Pomatias elegans (Müller 1774) is a Mediterranean and west European snail with a restricted, mainly southern, distribution in the British Isles (Kemey and Cameron 1979). In December 1993 the authors discovered two shells of *Pomatias elegans* in Brantingham Dale in the former East Riding of Yorkshire (Watsonian vice-county 61). Only a small number of northern stations are known, the nearest to Brantingham being in the North Riding at Forge Valley (Kerney 1968).

Brantingham Dale is a 2km long valley running approximately north-east to south-west, on the south western scarp slope of the Yorkshire Wolds. The valley, although now largely planted with woodland, still retains a good chalk grassland flora and is designated a Site of Special Scientific Interest (SSSI). The shells were found low down on the valley side (SE 945308) in an area closely covered with a secondary woodland growth consisting mainly of sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*). Most of the ground surface was unvegetated with a layer of leaf litter covering a chalk scree slope. Dog's mercury (*Mercurialis perennis*) occurred in patches, particularly higher up the slope. The presence of occasional cowslip (*Primula veris*) plants suggests that the canopy may have been more open at some time in the past. A few tens of metres north of the site there is a band of herb-rich chalk grassland extending from the floor to the rim of the valley.

The site held a relatively rich snail fauna: a list of all species recorded is contained in Table 1. The two original shells of *P. elegans* were found, in close proximity, in the leaf litter. Further searches of the site have provided seven more shells. In an attempt to locate live specimens the valley was visited on a mild, wet morning in May 1994, but although many molluscs were active, no live specimens of *P. elegans* were seen.

P. elegans has not previously been recorded in the East Riding although Petch (1904) considered the Wolds to be a suitable habitat; the Brantingham Dale area has been well worked by conchologists since his time but no records of this species have been made. In view of the potential importance of this find, the Yorkshire Naturalists' Union mollusc recorder, Mr A. Norris, was sent one of the specimens. The identification of the specimen was confirmed but Mr Norris, after consultation with the National Recorder, Dr Kerney, believed the specimens to represent sub-fossil shells originating from a wash-out in the chalk scree.

TABLE 1.
List of snails determined from shells found on the wooded scree slope Brantingham Dale.

Pomatias elegans (Müller)	**Oxychilus cellarius* (Müller)
Carychium tridentatum (Risso)	*Cecilioides acicula* (Müller)
Cochlicopa lubricella (Porro)	**Cochlodina laminata* (Montagu)
Vertigo pygmaea (Draparnaud)	**Clausilia bidentata* (Ström)
Pupilla muscorum (Linné)	*Helicella itala* (Linné)
Vallonia costata (Müller)	**Trichia striolata* (Pfeiffer)
Vallonia excentrica Sterki	**Arianta arbustorum* (Linné)
Discus rotundatus (Müller)	**Cepaea nemoralis* (Linné)
Vitrea contracta (Westerlund)	

* *indicates species seen as live animals, others determined only from empty shells.*

Although Brantingham Dale only appears to represent a former station of the species, the record is still of considerable interest. Examination of the distribution map for the species (Kerney 1972) reveals that the site fills a gap in the distribution of the species between its northern limit in Forge Valley and former stations in Lincolnshire. It also raises the possibility that the species may still be found on the Yorkshire Wolds.

The robust nature of the *P. elegans* shell and its burrowing habit mean that shells can persist in the soil for many thousands of years. Indeed, specimens dating from the Bronze Age have been found at Castlethorpe in the Ancholme valley, Lincolnshire, a little over 20km to the south of this site (Preece & Robinson 1984). It may be noteworthy that all of the shells were found on the lower third of the valley side, indicating that a considerable period of soil creep may have modified a more even distribution over the slope.

In Britain *Pomatias elegans* occurs in a variety of calcareous habitats but shows a preference for limestone banks with a certain amount of scrubby cover and a rubbly substrate in which to burrow (Kerney 1972, Cameron & Redfern 1976). As previously noted, there is some botanical evidence to suggest that the site was once more open than at present. The list of shells recovered from the site (Table 1) reveals many species typical of dry open sites rather than of woodland. This is exemplified by the discovery of two worn shells of *Helicella itala*, another species which is now in decline. It would be tempting to suggest that it was changes in vegetation that made the area unsuitable for *Pomatias elegans*. This may be true in a very local sense but the valley as a whole still has open habitats which would be expected to be suitable. *Pomatias elegans* is known to have declined in many parts of Britain (Kerney 1972) and is considered to be virtually extinct over the whole of East Anglia and Lincolnshire (A. Norris *pers. comm.*). It is thought that human disturbance and long term climatic changes, particularly a greater incidence of frost, may be responsible (Kerney 1968).

Acknowledgements

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VERTIGO GEYERI (LINDHOLM 1925), A SNAIL NEW TO YORKSHIRE

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On 21 May 1994, during the YNU excursion to the Law Dalby area, a single live specimen of *Vertigo geyeri* (Lindholm 1925) was found in the marshy area at Ellers Springs SSSI (SE44/857849) by the author. Initially this was erroneously recorded as a juvenile specimen of *V. antivertigo* (Drap.). Subsequently, a site list was received by the author form A. A. Wardhaugh in which he recorded *V. pygmaea* (Drap.). The original specimen was then re-examined and showed some marked differences to *V. antivertigo*. The specimen was then forwarded to Dr M. P. Kerney at The Natural History Museum, London who confirmed that it was in fact *V. geyeri*, a new county record.

This record is only the third for this species from Britain, the others being Tarn Moor, Cumbria (Coles & Colville 1978) and Cors Erddreiniog, Anglesey (Colville 1994). It is known from several sites in Central Ireland (Norris & Pickrell 1972), and is of local occurrence in the remainder of Europe. This new record therefore extends its eastern range within the British Isles.

Due to the interesting nature of the discovery the site was revisited on 19 September 1994. Weather condition on both dates were very wet. Ellers Springs is at an altitude of 60-65 metres and consists of several springs emerging from the higher ground and flowing over blocks of Jurassic limestone towards a shallow man-made pool. The areas between the flowing water remain wet throughout the year and there are small tufaceous deposits scattered throughout it. An unmettled track, which runs north to south, conveniently splits the area in two, both sides of which have good sedge and rush growth, including *Shoenus nigricans* L. and *Carex lepidocarpa* Tausch, interestingly recorded from all *V. geyeri* sites in Britain. Other species of interest are *Carex panicea* L. and *Carex dioica* L., which have also been recorded from the Tarn Moor site (Coles & Colville 1979). All four species were growing on the western side of the track, where the original specimen was found.

This area was re-examined and a further three live specimens of *V. geyeri* were found in clumps of sedge growing on tufaceous deposits. A very small quantity of litter was removed by Dr B. Colville and when dried and sifted, this yielded a further 9 specimens. This area is referred to as Site A in Table 1.

The higher ground on the east of the track was also examined (site B in Table 1). This area is of a more acid nature (D. R. Grant, *pers. comm.*) and did not produce any specimens of *V. geyeri* although it did not show some similarities to site A. The third area examined (site C in Table 1) was again on the eastern side and only slightly more elevated than site A. This site was much wetter and had a smaller quantity of sedge and large quantities of moss. Once again no specimens of *V. geyeri* were found. The last area to be examined (site D in Table 1) on the immediate eastern side of the track showed the closest similarity to site A. No specimens were found at the time but a small amount of litter later revealed a single dead shell of *V. geyeri*.

V. geyeri appears to be very limited in its distribution at this site, being restricted to an area some 20 x 20 metres on the west side of the track. I do not believe that the single dead shell found at site D was accidentally introduced by floods, as any debris would wash east to west. *V. geyeri* appears to be highly specific in its choice of microhabitat, being found amongst sedge growing on tufaceous deposits in areas with no moss growth about the bases of the plants. It also appears to be absent form the extremely wet areas in which other *vertiginidae* are to be found. A further examination of similar sites in the area to establish its presence or absence would be of great interest. Any specimens of *Vertiginidae* found in such areas should be carefully examined.

A full list of associated mollusca found at sites A to D is given in Table 1.

I would like to thank Dr B. Colville and Mr A. Norris for their assistance and

encouragement in the preparation of this note and Dr M. P. Kerney for verifying the original specimen. I would also like to thank Dr. Clayton of English Nature for permission to revisit the site.

TABLE 1
Associated Mollusca at Ellers Springs

	A	B	C	D
Lymnaea truncatula	*	*	*	*
L. peregra			*	
Carychium minimum	*	*	*	*
C. tridentatum	*	*		
Oxyloma pfeifferi	*	*	*	*
Cochlicopa lubrica	*		*	
Vertigo antivertigo	*	*	*	*
V. substriata	*		*	*
V. pygmaea	*			*
V. geyeri	*			*
Leiostyla anglica	*	*		
Vallonia pulchella	*			
Punctum phygmaeum	*	*	*	*
Arion intermedius	*			
Vitrea crystallina	*			*
Nesovitrea hammonis	*	*	*	*
Deroceras laeve	*			
Euconulus alderi	*	*	*	*
Trichia hispida			*	

A = west side of track
B, C, D = east side of track:
B Higher ground
C Wetter area next to wall
D Area immediately to east of track

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ROAD VERGE HALOPHYTES IN S.E. YORKSHIRE

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SUMMARY

The de-icing of roads with rock salt has resulted in a large number of records for halophytic plants from the major road and motorway network over the British Isles. During 1994 records for several maritime species were gathered from the verges of salt-treated minor roads in the Holderness area of S.E. Yorkshire. The presence of such populations alongside relatively quiet minor roads has enabled preliminary observations to be made about their distribution and hypotheses to be proposed regarding the mechanisms by which they are dispersed. The ecological significance of the deliberate pollution of some the last remnants of permanent grassland in an intensively farmed area of the region is noted.

INTRODUCTION

For several years I have been recording the presence and persistence of Danish Scurveygrass (*Cochlearia danica* L.) along the verges and central reservations of trunk roads and motorways in counties south of Yorkshire, but have not taken much notice of what has been happening near home. Late in 1993 I noted Sea Aster (*Aster tripolium* L.) growing by the A63 to the west of Hull, an event which stimulated me to look for other maritime species along road verges in the Hull area.

When I first started my searches, in May 1994, I believed that halophytes were to be found only on the verges and central reservations of salted trunk roads. I have now changed this belief. So far I have noted *Aster tripolium*, Grass-leaved Orache (*Atriplex littoralis* L.), Lesser Sea-spurrey (*Spergularia marina* (L.) Griseb.) and Reflexed Saltmarsh-grass (*Puccinellia distans* (Jacq.) Parl.) by the side of salted 'B' class and minor roads in Holderness. In addition, I have found *C. danica* on trunk roads to the west of Hull, probably the first inland records for *C. danica* in V.C. 61. Another interesting find is the *intermedia* subspecies of *Plantago major*, a subspecies with a predeliction for saline habitats.

The following list of records leads to a discussion about the possible methods of spread within the Holderness area and the ecological consequences of de-icing with rock salt.

Aster tripolium

The A63 populations of this species were sprayed by highway maintenance workers early in 1994 but I have since recorded it on the verge of the recently constructed Hedon bypass in Holderness [TA12]. These first-year plants are vulnerable to roadside verge cutting and are unlikely to flower and fruit in 1995. Coincidentally I found Foxtail Barley (*Hordeum jubatum* L.). This alien species from North America is usually introduced onto roadside verges by the sowing of grass seed mixes and it persists where there is salt.

Atriplex littoralis

In two places [both TA22], plants were found in 'grips' (shallow drainage channels cut at a right angle to the road edge) in which sand and grit had accumulated to form a 'micro dune'. In two other places [both TA32] the plants were growing together with Spear-leaved Orache (*Atriplex prostrata* Boucher ex DC.) on disturbed bare soil where cars are frequently parked by the roadside.

Spergularia marina

This species was found in the same locations as the *Atriplex littoralis* and occupied areas of the road verge which are persistently wet for most of the growing season, for example in wheel ruts and gulleys in silt caused by running water. In general, records for this were found while investigating other species and it is possible that it is more widespread than I currently know.

S. marina was found growing 'behind' *P. distans* and in three places occurred in considerable quantity in a small area suggesting that it had persisted there for at least one fruiting season.

I have found *S. marina* forming continuous dense strips along the road verge south of Carter Bar high on the Cheviots. Here it grows along the edge of gulleys where water has coursed down the road verge, suggesting that running water is a principal method of spread in this species. Holderness is markedly short of inclines so I do not expect *S. marina* to become as widely distributed as *P. distans*.

Puccinellia distans

This species occurs in near-continuous strips along the verges of salted minor roads throughout Holderness, along the A63 and M62 and along some roads to the east side of the Wolds (Driffield, Beeford, Bridlington etc.). It is so widespread along the salted minor roads that I can hypothesize on its dispersal (see Discussion).

Cochlearia danica

Early in May I noted *C. danica* by the M180 near Grimsby and then on the A15 approach to

the Humber Bridge in V.C. 54. As my journey progressed in V.C. 61 I found some near Hessle, not far from the Humber Bridge [TA02]. I believe that *C. danica* has entered V.C. 61 via the Humber Bridge rather than along the M62/A63. Later in the month I found it by an exit slipway from a service station on the west-bound carriageway of the A63 near Swanland/Ferriby [SE92] and then in considerable quantity along the eastbound carriageway of the M62 near Howden/Saltmarshe Grange [SE72]. In all of these places plants were seen on the nearside verge at, and for a short distance after, the emergence of a slip road onto the carriageway.

Plantago major subsp. intermedia

This unusual plant occurs on Spurn [TA41] and on the splash and spray zone of the sea defences and promenades at Withernsea [TA32]. I have found it as a road verge species in North Lincolnshire but only late in the 1994 season did I start to find it in Holderness. In both locations it occurred with subsp. *major* but occupied otherwise bare ground just off the road surface itself and in accretions of silt in potholes at the road edge. The *major* subspecies occurred on bare ground further away from the road edge, clearly demonstrating the ecological differences between the two.

Discussion

Preliminary observations on the distribution of *P. distans* on minor roads reveal that it occurs only in places where the verge abuts directly to the road (i.e. no footpaths) and then only where the road surface is level with or higher than the verge. This is an important factor for salt exposure and for the resulting denudation of competitive species along the margin of the road verge. It occurrs equally abundantly on either side of the road, irrespective of the compass-point orientation of the road, suggesting that prevailing wind direction and carriage of caryopses by wind-blown water spray is unlikely to be a factor in the side-relative distribution of populations, as seen on motorways, but may be an important factor in the spread of caryopses with the flow of traffic.

The caryopses are ripe and are already dehiscing by August, just as the flail mowers emerge; this could be the main agency for spreading *P. distans* and perhaps also some of the other road verge species, e.g. *Atriplex prostrata*, which occur extensively along our road verges, both treated and untreated.

P. distans produces a further crop of caryopses in autumn. I suspect that these are spread by motor vehicles which could pick up caryopses in mud and slush on mudflaps and wheel arches, especially on their nearside. Evidence for this is the presence of *P. distans* only on the nearside verge of several unsalted roads for a distance of a few metres from their junction with a salted road. In some respects this situation is analogous to the presence of a seemingly greater abundance of *C. danica* and *P. distans* over a short distance on the nearside verge at the bottom of slip roads onto motorways and at road intersections. In both cases, this zone is where vehicles are accelerating and where the likelihood of lumps of mud and slush to fall away from the vehicle is the greatest.

I believe that motor vehicles themselves are important carriers of seed and caryopses and as the agents of long-distance distribution to form new foci of growth from which spread by other agencies, such as flail mowing, wind and spray conditions and carriage by flowing water, then proceeds.

Although it is interesting to make these records, observations and hypotheses, I am aware of the ecological damage that salt de-icing, a deliberate pollution, causes. The road verges of Holderness are some of the last remnants of undisturbed neutral grassland in this intensively farmed area. Although the salt-affected verge is only a strip of about half a metre width, it is this zone which has a regularly-maintained mowing regime (correctly timed or not) and therefore has the most potential for maintaining a diverse flora. For economic reasons, salting is confined to the busier roads and it is still possible to find 'jewels' on some of the back lanes.

This study has caught the situation early with respect to *S. marina* and *A. littoralis*, i.e.

focal populations have only just started to appear and I intend to establish a 'baseline' distribution of these species within selected mapping tetrads during 1995 to enable subsequent spread to be monitored. Continued recording of the spread of what are effective 'salt pollution indicators' is essential in the preparation of justified opposition to salt de-icing.

BOTANICAL REPORTS FOR 1993: FLOWERING PLANTS AND FERNS

Compiled by L. MAGEE

The recorders thank all those who have sent in records. The names of contributors are given in full the first time that they appear in each report, initials being used thereafter. The names of species are in accordance with those used in Stace, Clive A. (1991) *New Flora of the British Isles* and Kent, D. H. (1992) *List of Vascular Plants of the British Isles.*

*Denotes a first v.c. record

EAST YORKSHIRE (VC61) (F. E. CRACKLES)

This report contains additional 10 km x 10 km square records for species of significance and hybrids not previously recorded for more than eleven squares, except where otherwise stated.

Polystichum aculeatum (L.) Roth Roadside ditch, near Molescroft 54/04, 1992; Dews.

Clematis vitalba (L.) Embankment of disused railway, Middleton 44/94; J.D.

Ranunculus aquatilis L. Swine Moor 54/04, 1991; J.D.

R. circinatus Sibth. Pond by Market Weighton Canal, Newport 44/83; Freshwater Biological Section field meeting, per D. Grant.

Fumaria densiflora DC. Arable, Etton Wold 44/94; J.D. conf. Dr. M. G. Daker, per E. Chicken. The first v.c. 61 record for this species as a British native. Previous records: Hull docks, 1902; C. Waterfall: Bridlington 54/16, 1945, E. W. Holder, Herb. LIV are taken to be of casual status.

Myosoton aquaticum (L.) Moench Swine Moor, Beverley 54/04; J.D.

Salix triandra x *S. viminalis* = *S.* x *mollissim* Hoffm. ex Elwert Bank of River Derwent, Wheldrake Ings 44/74; C. D. Preston.

S. viminalis x *S. caprea* = *S.* x *sericans* Tausch ex A. Kerner Bank of River Hull, near Tickton 54/04, 1992; J.D.

Descurainia sophia (L.) Webb ex Prantl Farmland rubbish tip, near Leven 54/04. 1991; J.D.

Barberea stricta Andrz. Drain Bank, near Long Riston 54/14; J.D.

**Rorippa sylvestris* x *R. amphibia* = *R.* x *anceps* (Wahlenb.) Reichb. Marshy grassland, Wheldrake Ings 44/74; C.D.P.

R. amphibia (L.) Besser Flooded excavation, near Eske 54/04; J.D.

Coronopus didymus (L.) Smith Hemingborough 44/63; M. Hunter and arable, Etton Wold 44/94; J.D.

Cakile maritima Scop. Below cliffs, Hornsea 54/24, 1991; J.D.

Oenthera glazioviana Micheli ex C. Martius Gravel pit. Brandesburton 54/14, 1992; J.D.

Geranium pyrenaicum Burman f. Roadside verge, near South Dalton 44/94, 1992; J.D.

Myosotis ramosissima Rochel Gravel pit, near Brandsburton 54/14; J.D.

Mentha arvensis x *M. aquatica* = *M.* x *verticillata* (L.) Wheldrake Ings 44/74; C.D.P.

Callitriche hamulata Kuetz. ex Koch Wheldrake Ings 44/74; C.D.P.

Linaria repens (L.) Miller Embankment of disused railway, near Leconfield 54/04, 1991 and disused chalk quarry, Goodmanham 44/94; J.D.

Centaurea cyanus L. Roadside verge, near Barfhill 54/04, 1992, not re-found, 1993; J. D. This now rare species was in plenty in a cornfield in the same area in 1957; F. E Crackles.

Lactuca serriola L. Beverley 54/04, 1992; J.D. and disused railway, Middleton 44/94; J.D.

L. virosa L. Disused railway, Enthorpe 44/94; J.D.

Aster tripolium L. Frequent by Clive Sullivan Way from just east of the Humber Bridge to William Wright Dock in west Hull 54/02; P. Cook.

Conyza canadensis (L.) Cronq. Disused railway, Goodmanham 44/84 and Middleton 44/94; J.D.

Anthemis cotula L. Roadside verge, near Leven 54/04, 1992; J.D.

Bidens tripartita L. Marshy grassland, Wheldrake Ings 44/74; C.D.P.

**Elodea nuttallii* (Planchon) H. St. John Barmston Drain, Beverley 54/04; J.D. and ditch, Wheldrake Ings 44/74; C.D.P.

Potamogeton perfoliatus L. By bridge over the River Derwent, Wheldrake Ings 44/64; C.D.P.

P. pusillus L. Fishing pond, Newport 44/83; FWBS field meeting, per D.G.

**P. trichoides* Cham. & Schldl. Former course of the River Derwent, and ditch Wheldrake Ings 44/74; C.D.P.

Carex divulsa Stokes subsp. *leersii* (Kneucker) W. Koch Disused railway, near Keyingham 54/22; P.C., det. C. Jermy.

Nardus stricta L. Swine Moor 54/04, 1990; J.D., confirming an old record.

Milium effusum L. Oldflat Wood, Harswell 44/84; M. Whittaker.

Cephalanthera damasonium (Miller) Druce One Plant, disused railway between Gardham and Kipling Cotes 44/94; A. Marshall.

Dactylorhiza fuchsii x *D. purpurella* = *D.* x *venusta* (Stephenson & T. A. Stephenson) Soó Waste ground, Withernsea 54/32; M. Cook.

North-East Yorkshire (VC62) (T. F. Medd)

Ceratophyllum demersum L. Ditch, Rye Mouth 44/87; YNU Fresh Water Biological Section Excn.

Ranunculus penicillatus (Dumort.) Bab. ssp. *pseudofluitans* (Syme) S. Webster Costa Beck 44/87; YNU FWBS Excn.

Chenopodium bonus-henricus L. Roadside, Marishes 44/87; YNU FWBS Excn.

Stellaria neglecta Weihe between R. Rye and Derwent 44/87; YNU FWBS Excn.

S. palustris Retz. Between R. Rye and Derwent 44/87; YNU FWBS Excn.

Sagina nodosa (L.) Fenzl Spaunton Knowl 44/79; YNU Excn.

Silene noctiflora L. Caulkleys, Bank, Nunnington 44/67; T.F.M. Confirmation of old record.

Hypericum elodes L. Spaunton Moor 44/79; YNU Excn.

Lysimachia nummularia L. Between R. Rye and Derwent 44/87; YNU FWBS Excn.

Coronopus squamatus (Forsskål) Asch. Bootham Stray, York 44/65; York & DFN Soc.

Rubus nemoralis P. J. Mueller Hutton Common 44/78 and Lastingham 44/79; YNU Excn. det. D. Grant.

R. ulmifolius Schott Hayburn Wyke 54/09; YNU Bry. Sec. Excn. det. D.G.

R. vestitus Weihe Hutton Common 44/78; YNU Excn. det. D.G.

R. mucronulatus Boreau Buttercrambe Wood, Bossall 44/76; D.G.

R. pallidus Weihe Hutton Common 44/78; YNU Excn. det. A. Newton.

R. dasyphyllus (Rogers) E. Marshall Buttercrambe Wood 44/76; D. G. Hutton Common 44/78; YNU Excn. det. D.G.

R. eboracensis W. C. R. Watson Hutton Common 44/78; YNU Excn. and Hayburn Wyke 54/09; YNU Bry. Sec. excn. det. D.G.

R. warrenii Sudre Hutton Common 44/78; YNU Excn. det. D.G.

Prunus padus L. Troutsdale 44/98; D.G.

Melilotus officinalis (L.) Lam. Banks of R. Dove, Keldholme 44/78; L. Magee

Euonymus europaeus L. Caulkleys Bank 44/67; T.F.M.

Euphorbia exigua L. Caulkleys Bank 44/67; T.F.M. Banks of R. Rye 44/87; YNU FWBS Excn.

Silaum silaus (L.) Schinz & Thell. Hutton Common 44/78; YNU Excn. Between R. Rye and Derwent 44/87; YNU FWBS Excn.
Myosotis secunda A. Murray Strensall Common 44/65; R. Freer.
Verbena officinalis L. Banks of R. Rye 44/87; YNU FWBS Excn.
Lamium confertum Fries Ingleby Greenhow 45/50; V. Jones per J. Blackburn. First record this century.
Clinopodium ascendens (Jordan) samp. Caulkleys Bank 44/67; T.F.M. Confirmation of a pre-1930 record in Atlas.
Veronica catenata Pennell Stream, Bootham Stray, York 44/65; Y&DFNS.
Pinguicula vulgaris L. Spaunton Moor 44/79; YNU Excn.
Utricularia vulgaris L. Still at Strensall Common 44/65; flowered very well in 1993, R. Freer.
Legousia hybrida (L.) Delarbre Set-aside land, Caulkleys Bank 44/67; Y&DFNS. Near Kirkbymoorside 44/78; N. Sykes.
Sherardia arvensis L. Caulkleys Bank 44/67; T.F.M. Hutton Common 44/78; YNU Excn.
Valerianella dentata (L.) Pollich Caulkleys Bank 44/67; T.F.M. Not in atlas but confirmation of 1973 record.
Potamogeton friesii Rupr. R. Rye (at junction with Costa Beck) 44/87; YNU FWBS Excn.
Eleocharis quinqueflora (F. Hartmann) O. Schwarz Tranmire Plain 44/79; YNU Excn.
Carex disticha Hudson Aldwark Moor 44/46; Y&DFNS.
C. dioica L. Tranmire Plain 44/79; YNU Excn.
C. vesicaria L. Rye Mouth 44/87; YNU FWBS Excn.
Melica uniflora Retz. Aldwark Wood 44/46; T.F.M.
Helictotrichon pubescens (Hudson) Pilger between R. Rye and Derwent 44/87; YNU FWBS Excn.
Molinia caerulea (L.) Moench Aldwark Moor 44/46; Y&DFNS.
Typha angustifolia L. Marishes 44/87; YNU FWBS Excn.

South West Yorkshire (VC63) (D. R. Grant)

Equisetum telmateia Ehrh. Old railway, Worborough 44/3303; Dr. L. Lloyd-Evans.
Ranunculus lingua L. Potteric YWT Reserve 44/5900; D. Bramley.
R. circinatus Sibth. Mickletown Flash 44/4027; YNU Freshwater Biological Section Excn.
Carpinus betulus L. Nr. Oughtibridge 43/3192; E. Thompson.
Salix repens L. Kirkthorpe 44/3520; C. Hartley.
Rorippa amphibia (L.) Besser Mickletown Flash 44/4027; D. R. Grant.
Primula vulgaris Hudson Cow Ark, Bowland 34/6943; L.Ll-E.
Rubus tuberculatus Bab. Silcoates, Wakefield 44/3022; D.R.G.
R. warrenii Sudre Gomersal 44/2125; T. Schofield.
R. ulmifolius Schott. Storrs Hill, Ossett; D.R.G.
R. rufescens Lef & P. J. Mueller Worsborough Reservoir 44/3403; D.R.G., det. A. Newton.
R. nemoralis P. J. Meuller Thorpe Marsh YWT Reserve 44/5809; T.S.
R. hylocharis W. R. C. Watson High Bradfield, 43/2692; D.R.G.
R. echinatus Lindley Pildacre Hill, Ossett 44/2620; D.R.G., det. A. Newton.
R. newbouldii Bab. Riverside, Dewsbury 44/2521; D.R.G., det. A. Newton.
R. sprengelii Weihe Beeley Wood, Oughtibridge 43/3192; T.S.
R. scissus W. R. C.Watson St. Ives, Bingley 44/0838; D.R.G.; Chellow Dene, Bradford; 44/1134; T.S.; Thorne Waste Reserve 44/7215; YNU Botanical Section Excursion.
R. plicatus Weihe & Nees Thorne Waste Reserve 44/7215; D.R.G.
Smyrnium olusatrum L. South Elmsall 44/4712; E.T.
Pastinaca sativa L. Shaftholme, nr. Doncaster 44/5609; E.T.
Foeniculum vulgare Miller Normanton 44/3823; D. Procter.
Mentha suaveolens Ehrh. Pildacre Hill, Ossett 44/2620; D.R.G.
Melampyrum pratense L. High Bradfield 43/2692; L.Ll-E.
Inula conyzae (Griess.) Meikle Knottingley 44/4922; D.P.

Lactuca serriola L. Pugney's, Wakefield 44/3218; D.P.
Glyveria notata L. Chevall, Carr Head, Glusburn 34/9744; T.S.
Aira caryophyllea L. Railway banking, Methley 44/3728; T.S.
Vulpia myuros (L.) Gmelin Upton Colliery tip 44/4813; J. Lunn.
Dactylorchis purpurella (Stephenson & T. A. Stephenson) Soó Redbrook tip, near Barnsley 44/3207; J.L.

Mid-West Yorkshire (VC64) (L. Magee)

A large number of interesting records were received from all over the vice-county and it is only possible to list a selection here. The recorder thanks the contributors.

Asplenium adantium-nigrum L. Ashlar goits, Barden Moor 44/05; L. Magee.
Phyllitis scolopendrium (L.) Newman Sherburn-in-Elmet 44/4933; E. Thompson.
Ranunculus lingua L. Lowther Pond, Allerton Bywater 44/42; YNU Freshwater Biological Section Excursion.
Clematis vitalba L. Barlow Common 44/6328; E.T.
Actaea spicata L. Penyghent Gill 34/8774; D. R. Grant.
Cerastium arvense L. Bank of River Ouse, York 44/5456; P. Abbott.
Hypericum humifusum L. Stubbings Moor 44/34; P.A.
Salix purpurea L. Hackfall Woods 44/2377; YNU Excn.
Barbarea intermedia Boreau Nr. Hellifield 34/8555; P.A.
Hottonia palustris L. Old Railway, east of Wetherby 44/44; P.A.
Crassula helmsii (Kirk) Cockayne Farnham gravel pit 44/3559; S. J. Evison.
Rufus scissus W. R. C.Watson Adel Valley, Leeds 44/2839; D.R.G.
R. spregelii Weihe Bolton Abbey 44/0755; D.,R.G. Brayton Barff, Selby 44/5830; D.R.G.
R. anisacanthos G. Braun Adel Valley, Leeds 44/2839; D.R.G., det. A.Newton.
R. eboracencis W. R. C.Watson Shipley 44/1638; D.R.G.
R. warrenii Sudre Neat Pateley Bridge 44/1644; D.R.G.
Securigera varia (L.) Lassen Temple Newsam 44/33; L.M.
Myriophyllum spucatum L. Fish Pond, Sherburn-in-Elmet 44/43; L.M.
Epilobium brunnescens (Cockayne) Raven & Engelhorn Goits on Barden Moor 44/05; L.M.
Geranium versicolor L. Malham village 34/96; L.M.
Oenanthe aquatica (L.) Poiret Red House Wood, Moor Mokton 44/5257; P.A., Nether Poppleton 44/5455; P.A.
Lithospermum officinale L. Scotton Banks, Knaresborough 44/3357; D.R.G.
Myosotis stolonifera (D.C.) Gay ex Leresche & Levier Angram Reservoir 44/07; L.M., Scarhouse Reservoir 44/07; L.M.
Limosella aquatica L. Near Staveley 44/3663; D. J. Tennant.
Littorella uniflora (L.) Asch. Barden Reservoir 44/05; L.M.
Veronica anagallis-aquatica L. Strid Wood, Bolton Abbey 44/05; L.M.
Parentucellia discosa L. Caruel Nr. Micklefield 44/4332; P.A.
Cicerbita macrophylla (Willdr.) Wallr. All Alone, Bramhope 44/2342; L.M., King Lane, Alwoodley 44/2841; L.M. Scotland Lane, Horsforth 44/2324; L.M.
Conyza canadensis (L.) Cronq. West Bank of River Ouse, York 44/55; L.M.
Senecio fluviatilis Wallr. Tarn House, Malham 34/86; YNU Excn.
Potomogeton pectinatus L. Nr. Staveley 44/3663; D.J.T.
P. barchtoldii Fieber, Nr. Staveley 44/3663 D.J.T.
Zannichellia palustris L. Ditches nr. Gascoigne Wood sidings 44/53; YNU FWBS Excn., Lowther Pond, Allerton Bywater 44/42; YNU FWBS Excn.
Lemna trisulca L. Lowther Pond, Allerton Bywater 44/42; YNU FWBS Excn.
Carex paniculata L. Beaverdyke Reservoir 44/2154; D.R.G.
Carex strigosa Hudson Hackfall Wood 44/2377: YNU Excn. In new sites and increasing: Loftwood, Bilston-in-Ainsty 44/4748; P.A.
Carex nigra (L.) Reichard var. *juncea* Tarn Fen, Malham 34/86; YNU Excn. conf. D.R.G.

Calamagrostis stricta Koeler Tarn Fen, Malham 34/86; D.R.G., confirmation of old record.
Dactylorchis fuchsii x *D. praetermissa* = *D.* x *grandis* (Druce) P. Hunt Roadside nr. Gascoigne Wood sidings 44/53; YNU FWBS Excn., more than 100 flowering spikes.

CORRECTION TO 1986 REPORT
Ranunculus fluritans L. Collingham 44/42; L. Magee = *R. penicillatus* subsp. *pseudofluitans* (Syme) S. Webster.

NORTH-WEST YORKSHIRE (VC65) (T. F. MEDD)
Equisetum pratense Ehrh. High Birk Hat, Baldersdale 35/91; M. Sykes.
Primula farinosa L. Deepdale 34/78; A. J. Stoddard.
Potentilla palustris (L.) Scop. Hutton Moor 44/37; Dr. E. Kay.
Limosella aquatica L. Nosterfield 44/27; H. E. Stace.
Campanula glomerata L. Leeming Bar; 44/29; E.K.
Festuca vivipara (L.) Smith Uldale; A.J.S.
Paris quadrifolia L. Dentdale 34/78; A.J.S.

CASUALS AND ADVENTIVES (E. CHICKEN)

Since the 1992 report, 100 records have been received from five recorders for 60 taxa. More than half of these records are from J. Martin for plants found in the fields treated with shoddy in theWakefield area. A number of our members were able to join the B.S.B.I. recorders field meeting in this area and saw many of the plants that have been listed in this report from year to year. Particularly noteworthy this time are *Hedysarum coronarium* of which it is thought there are only about four confirmed British records since 1930, and *Berkheya rigida*. The following records are a selection of those received. The contributor is assumed to be the determiner unless otherwise stated.

Brassica juncea (L.) Czern. (61) Birdseed alien in garden, Driffield 54/05; E. Chicken.
Fallopia baldschuanica (Regel) Holub (64) near Nessfield, Ilkley 44/04; D. R. Grant.
Tolmiea menziesii (Pursh) Torrey & A. Gray (63) Bankfield near Cottingley Bridge 44/13; D.R.G.
Spiraea douglassii Hook. (63) Filled in mill dams, Holmfirth 44/10; Mrs J. Lucas.
Coronilla scorpioides (L.) Koch (63) Shoddy treated field, Kirkhamgate 44/32; J. Martin, B.S.B.I. meeting per E.C.
Hedysarum coronarium L. (63) Arable, Brandy Carr Farm, Carr Gate 44/32. 1992; J.M. det. E. J. Clement.
Lathyrus grandiflorus Smith (63) Bankside in urban Meltham 44/01; J.L.
Lupinus x *regalis* Bergmans (61) Driffield by-pass 54/058; E.C.
Acer platanoides L. (63) Bank of R. Holme, Holmfirth 44/40; J.L.
Oxalis megalorhiza Jacq. (62) Greenhouse weed. Sutton-under-Whitestonecliffe 44/84; E.C.
Erodium cygnorum Nees 963) Arable, Woodhouse Lane Farm, E. Ardsley 44/22. 1989; J.M. det. E.J.C.
Coriandrum sativum L. (63) Roadside, Meltham 44/10; J.L.
Brunnera macrophylla (Adams) I. M. Johnston (64) Corner of wood, Long Marston 44/95; Mrs P. P. Abbott.
Sambucus racemosa L. (64) Woodland near Hellifield 34/85; P.P.A.
Berkheya rigida (Thunb.) Bolus & Wolley-Dod ex Adams & Salt (63) Arable, Kirkhamgate 44/22; J.M. det. E.J.C.
Scolymus maculatus L. (63) Woodhouse Lane Farm, E. Ardsley 44/22; J.M. conf. E.J.C.
Aponogeton distachyos L.f. (63) By a wharf, Leeds 44/33; P.P.A.

CORRECTIONS TO 1986 AND 1993 REPORTS:
Eryngium bourgatii Gouan (64) 1986 as redetermined by Dr. A. C. Leslie as *Eryngium giganteum* Bieb.
Solanum sisymbriifolia Lam. (63) 1990 Doncaster was det. J.M. conf. E.J.C.

BOOK REVIEW

Waterfowl Ecology and Management by **Guy A. Baldassarre** and **Eric G. Bolden.** Pp. 609, with many b/w photographs, line drawings and diagrams. John Wiley, New York, 1994. £58.00.

This large volume deals with the waterfowl of North America with an emphasis on the preservation and management of habitats for breeding and hunting, but it is much more than that. For anyone interested in this group of birds beyond the identification level, it is a most fascinating and informative read. In fact, it covers the whole sphere of the group's ecology, including chapters on Classification, Courtship, Reproductive and Feeding Ecology, Major Wetland Habitats, Brood Rearing, Mortality and Harvest Management, this last named chapter including some staggering statistics. For instance, an extensive study in the 1970s by the U.S. Fish and Wildlife Service estimated that humans caused the deaths of 196 million birds per year which represented only 1.9% of the total waterfowl population in the Continental United States. Hunting accounted for 61%, collision with man-made objects (TV towers etc.) 32% and pollution 2%, with other, more obscure categories accounting for 1%. Since the 1980s, the annual harvest has remained below 10 million due to restrictive practices (i.e. bag limits) and lower populations.

Death due to epizooties is often on a large scale; for example, in the 1970s a Health Research Centre in Wisconsin recorded the deaths of 25,000 to 100,000 waterfowl and mass deaths of 5,000 to 10,000 were commonplace. Disease may now kill millions of birds each year and the problem has expanded in both geography and severity during the last 25 years. Without extensive monitoring, these mass deaths are often masked by rapid removal by predators, as in Missouri in 1980-81 when of 4,165 carcasses located, having died from non-hunting causes, only 934 were intact, the remainder having been partly eaten by scavengers. Of the intact carcasses, which were monitored daily, 44% disappeared after day 1, 68% by day 2, 79% by day 3 and 82% by day 4. This answers the question asked of me recently by a wildfowling friend when discussing the problems of lead shot: 'Why don't we see lots of dead ducks lying around?'

No less than 3,000 tons of lead shot were deposited into the wetlands of North America each year during the 1960s. It is likely that shot which misses its intended quarry ultimately causes the death of very many birds through ingestion and subsequent lead poisoning. It has been shown that those species feeding on hard grains such as maize grind up lead shot in the gizzard much more quickly than those feeding on softer grains and vegetation and are thus adversely affected much more severely. Although an unpopular move with many hunters, the phasing out of lead shot and the introduction of non-toxic alternatives will obviously benefit the waterfowl populations.

Each chapter ends with a list of the literature cited and for Major Wetland Habitats in North America there are no fewer than ten pages of references. The final chapter puts the case for and against hunting and argues convincingly that habitat management aimed in part at providing large duck and goose populations for hunting has benefited many species. Ironically, it is the rarer non-hunted species that are in danger of extinction or severe reduction in their numbers, due in the main to reduction of habitat.

An excellent book, packed with information which is presented in a clear and very readable manner. Anyone interested in the subject, whether at academic level or as someone who simply enjoys watching, or even shooting and eating ducks and geese will find much of interest within its 600 pages.

JRM

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Manuscripts (two copies if possible), typed double-spaced on one side of the paper only with margins at top and left-hand at least 2.5cm wide, should be submitted. Latin names of genera and species, but nothing else, should be underlined. S.I. Units should be used wherever possible. Authors must ensure that their references are accurately cited, and that the titles of the journals are correctly abbreviated. Volumes of *The Naturalist* for the years 1886 to 1975 have been retrospectively numbered 11 to 100 to accord with numbering before and after this period (see YNU *Bulletin* no. 3, pp. 21-22 1985); please cite these volume numbers in all references. Table and text-figures should be prepared on separate sheets of paper. Drawings and graphs, drawn about twice the linear size they are to appear, should be in jet-black Indian ink, and legends should not be written on the figures. **Publishable manuscripts not conforming to the above requirements will be returned for alteration.**

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record this deep appreciation of this imaginative gesture.

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CYSTOPTERIS FRAGILIS (L.) BERNH. VAR. *ALPINA* HOOK. IN BRITAIN

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Abstract
Cystopteris fragilis (L.) Bernh. var. *alpina* Hook. occurs in alpine regions of Continental Europe but was reported in the last century in North-West Yorkshire, VC65. This has been generally accepted as the only correct native British record. The general morphology and spore characters of the Yorkshire specimens are discussed and a history of the British records is given.

Introduction

There has been much confusion about the correct status and name for the taxon which is described in this paper as *Cystopteris fragilis* (L.) Bernh. var. *alpina* Hook. The noted British authorities on ferns in the last century, Moore (1860), Hooker (1861), Lowe (1876), Boswell-Syme (1886) and Babington (1904) in their taxonomic treatment of *Cystopteris*, all treated the epithet *alpina* as synonymous with another epithet, *regia*. In the above publications of Hooker, Boswell-Syme and Babington, the name *C. alpina* Desv. was used, whereas in Moore and Lowe *C. regia* Desv. was chosen. Under the rules of nomenclature the older epithet *regia* should have been used, which is certainly the reason that it was chosen by Moore. However, Moore (1860, p. 270) states that although the plant which he describes is generally admitted to be *Polypodium regium* of Linnaeus, the specimens in the Linnean Herbarium were unsatisfactory, whereas the taxon he describes was certainly the *Polypodium alpinum* of Wulfen.

Stansfield (1929) points out that Newman in his *British Ferns* claims that of the three specimens labelled *P. regium* in the Linnean Herbarium, the first appeared to be normal *C. fragilis*, the second *Asplenium fontanum* and the third *P. dentatum* of Dickson (i.e. *C. fragilis* var. *dentata* Hook.). Stansfield examined the Linnean specimens himself and agrees with Newman that the first specimen referred to above seemed to be a rather finely divided form of *C. fragilis* and did not appear to have any of the characters of the true *alpina*.

The Linnean sheet of specimens described as *P. regium* therefore appears to contain more than one taxon, none of which was certainly the same as the specimens of Wulfen, the latter according to Hooker (1861) being excellent. This is probably the reason that the epithet *alpina* is generally used today. The name *C. regia* has been used in later British publications, e.g. Hyde and Wade (1948) and Jermy and Harper (1971), but the epithet *regia* as a distinct one from *alpina* has probably persisted in Britain only in horticulture, where supposedly different taxa have been offered under these names, for example by Kaye (1968, p. 53). Hooker (1861) in describing the taxon as *C. alpina* Desv. states that in his opinion it was truly distinct (from *C. fragilis*), but Babington (1904) and most later British authors have treated it as a variety of *C. fragilis*. In the latest edition of *Flora Europaea* (Tutin *et al.*, 1993), however, it is treated as a true species, *C. alpina* (Lam.) Desv., in which it includes C. *regia* auct. plur. pro parte, and is distinguished from *C. fragilis* by its more deeply dissected pinnae and linear-oblong ultimate pinnae segments.

On the Continent, opinion had previously been divided concerning the status of *C. regia* and *C. fragilis* var. *alpina* as distinct taxa. According to Kestner (1930), three taxa have been described within the *alpina* complex, namely var. *alpina* (type). var. *regia* Milde and var. or sub-var. *deltoidea* Milde, the last being a high altitude form confined to Dolomitic limestone in the Tyrol. Kestner, however, suggests that var. *regia* is possibly only a variable lower altitude form of *C. alpina*, which he considers a good species, and that var. *regia* also appears to be somewhat intermediate between *C. alpina* and *C. fragilis*. Stansfield (1929) suggested that there were two main types of *C. alpina*, (i) forma *obtusa* which is bipinnate with only slightly notched pinnules, in which he included the *C. regia* of

Lowe (1876, Plate LXVII) and (ii) forma *dissecta*, more deeply divided, being tripinnate or quadripinnatifid with deeply notched ultimate segments, treating this as the true *alpina*, in which he included the plants from VC65. In this paper it has been assumed that the two epithets are in fact synonymous. However, the var. *regia* and the var. *obtusa* as described above by Kestner and Stansfield respectively may include hybrids as Vida (1974) stated that pentaploid hybrids of tetraploid *C. fragilis* s. str. and hexaploid *C. regia* (*alpina*) are frequent and intermediate in morphology between their parents. A summary of the history of the taxonomy is given in Moore (1860, p. 269).

The Records of *Cystopteris Fragilis* Var. *Alpina*

C. fragilis var. *alpina* is widespread on calcareous formations in alpine regions of Continental Europe, mainly between altitudes of 1,800 and 2,000m, but has been found at 2,800m, which is higher than any other species of fern has been recorded in Europe (Kestner 1930).

Only two British records of *C. fragilis* var. *alpina*, neither recent, have been accepted as correct. The first of these was from an old wall in Low Leyton, South Essex, VC18, where it existed in great plenty at the close of the 18th century according to Moore (1860), but was then so well established that it must have existed there much earlier. It is inconceivable that this fern with an alpine distribution outside of Britain could ever have been native in this lowland locality, although the circumstances in which it came to be there, so long before the era of enthusiasm for fern cultivation, remains a great mystery. The second authentic record dates from the 26 June 1872 when Richard Potter, an employee of Backhouse's plant nursery gardens in York, collected a fern in the presence of James Backhouse Jun. on Cronkley Fell in upper Teesdale, North-West Yorkshire, VC65, which Backhouse named as *C. alpina* Desv. In 1873 further specimens were collected there by one of Backhouse's sons, William Edward Backhouse, again in 1876 by James Backhouse, and finally by William Edward Backhouse in 1881. Only three plants were said to be present and no records since the latter date have been traced. The above specimens are in Edinburgh (**E**) and also in Kew (**K**).

The *Botanical Exchange Club Report* (1930, p. 287) states that G. C. Druce and F. A. Lees searched the Teesdale site in 1903 and again in 1909 but failed to refind the fern. Stansfield (1930) states that in his opinion there is no doubt that Backhouse's Teesdale plants are the true *alpina* and practically coincide with his *C. alpina* forma *dissecta* (Stansfield 1929), whereas the Low Leyton specimens seen by him in herb. **E** differed, although he considered that they could possibly be regarded as within the domain of the aggregate *alpina* or *regia*, and he included them in his *C. alpina* forma *obtusa* (Stansfield 1929).

There are several other old reports of *C. regia*. Moore (1860, p. 104) claims that he was sent authentic specimens by H. Shepherd of Liverpool which were said to have been gathered in both Yorkshire and Derbyshire, but no more precise localities were given. Moore also states that in his opinion a specimen collected on Saddleback in Cumberland, VC70. by S. F. Gray well prior to 1860 might also have been authentic. Unfortunately the specimens collected by Mr. Shepherd and Mr. Gray have not been traced. Moore (1860) further states that the various reports of other British stations probably referred to small much divided forms of *C. fragilis*. This applied to a plant collected in Llanberis, Caernarvon, VC49. by W. Madeley of Kingswinford, which F. A. Lees thought was *C. alpina* Desv. but was later determined by J. Backhouse Jun. as a variety of *C. fraglis* var. *angusata* (Sm.) Moore. This reference appeared in Lees notebooks (1876) housed in the Keighley Museum. A herbarium specimen which I have seen in herb. **E** collected on Cader Idris, Merioneth, VC48, in 1875 also resembles *C. fragilis* var. *alpina*, but is probably also another form of *C. fragilis*.

Morphology and Spore Characters

Two main characters are currently used to distinguish *C. fragilis* var. *alpina* from other

members of the *C. fragilis* complex, the first is the fine dissection of the fronds and the shape of the ultimate pinnule segments, the second is the position of the tips of the veins. Spore type has also been used by some authors to separate this taxon, and although the spores of certain forms of the var. *alpina* seem to be distinctive, this distinction was misinterpreted by some authors in the last century, as shown below.

A full description of *C. fragilis* var. *alpina* (from Teesdale) is given in Boswell-Syme (1886) and silhouettes of some of the specimens collected by Backhouse are shown in Figure 1. The ultimate pinnule segments are well separated, being narrowly oblong to near-cuneate, very obtuse with somewhat irregular shallow blunt teeth which have an emarginate or retuse sinus at the apex. Virtually all the ultimate veins terminate in the base of a small sinus at the apex of a tooth or in the notch between the teeth, and not at the apical points of the teeth as in most other forms of *C. fragilis*. This character is also found in *C. dickieana* R. Sim, but in this case the sinuses of the teeth are usually shallow and not so marked, and in contrast the pinnule segments are very broad and rounded. Boswell-Syme (1886, p. 106) states that in *C. eu-fragilis* (var. *genuina*) the veins with scarcely an exception run into the projecting teeth. According to Stansfield (1929), Kestner suggested that the character of the veins of the ultimate segments terminating in notches is the only reliable one for distinguishing *C. alpina*. However, I have noted that a few varieties of *C. fragilis* other than var. *alpina* can exhibit this character when they have not fully attained their ultimate mature frond form, even though fully fertile, and therefore this character needs to be interpreted with caution. Boswell-Syme (1886) and Babington (1904) used the character of the vein-endings, together with the spore characters (see below) in the separation of *C. fragiiis* var. *alpina* and *C. dickieana* from other forms of *C. fragilis*, Boswell-Syme even treating *dickieana* as a variety of *C. alpina*.

Boswell-Syme (1886, pp. 103-105) when referring to the Teesdale plants, states that the spores of var. *alpina* are tuberculate with sparse large blunt tubercles and that the spores of the var. *dickieana* were precisely similar to those of var. *alpina*, having blunt, rounded, slightly elevated tubercles and not spine-like ones as in *C. eu-fragilis*. Babington (1904, p. 527) groups *C. dickieana* with *C. alpina* Desv. describing their spores as warted, contrasting with the prickly spores of two described varieties of *C. fragilis*, but adds "verrucose" to the description of the spores of *C. dickieana*, and admits that he has placed *C. dickieana* and *C. alpina* under one species with much doubt. On examination of the spores of the Teesdale specimens I have found that they do match Boswell-Syme's description, but I cannot agree that they are a close match for those of *C. dickieana*. R. H. Roberts has examined the spores of the Teesdale specimens in more detail and agrees with this finding stating that the perispore is covered with short blunt protrusions, c. 2-3μm in length (Figure 1), unlike that of *C. dickieana* which has no spine-like protrusions. In the Teesdale plants, the perispore also fits closely round the exine (exospore) with no loose folds, and does not have a rugose appearance, again unlike that of *C. dickieana*. The outward appearance of the spores of the Teesdale specimens of *C. fragilis* var. *alpina* therefore bears no resemblance to those of *C. dickieana*. Boswell-Syme (1886) was therefore not correct in suggesting that the spores of the two taxa were precisely similar, and his treatment of *C. dickieana* as a variety of *C. alpina* Desv. was accordingly unjustified. Moore (1860, p. 270) had earlier stated that the spores (of *C. regia* Desv.) were echinate but this was prior to the discovery of the Teesdale plants and therefore referred to plants from Low Leyton, although he may have included others from Continental Europe. However, Boswell-Syme clearly recognised a difference between the short blunt tubercles of var. *alpina* from Teesdale and those of typical *C. fragilis*, which he described as numerous long slender sharp spine-like tubercles, whereas Moore (1860) simply described both types of tubercle as echinate, and, rather confusingly, some of the spores of *C. fragilis* which he illustrates (Plates CI and CII), are similar to those of the Teesdale *alpina*. The spores of *C. fragilis* var. *alpina* which I had collected in the Austrian Alps however had numerous long spines and they were therefore closer to typical *C. fragilis* in this respect. Stansfield (1929), when referring to Continental plants, states that the spores of *alpina* are

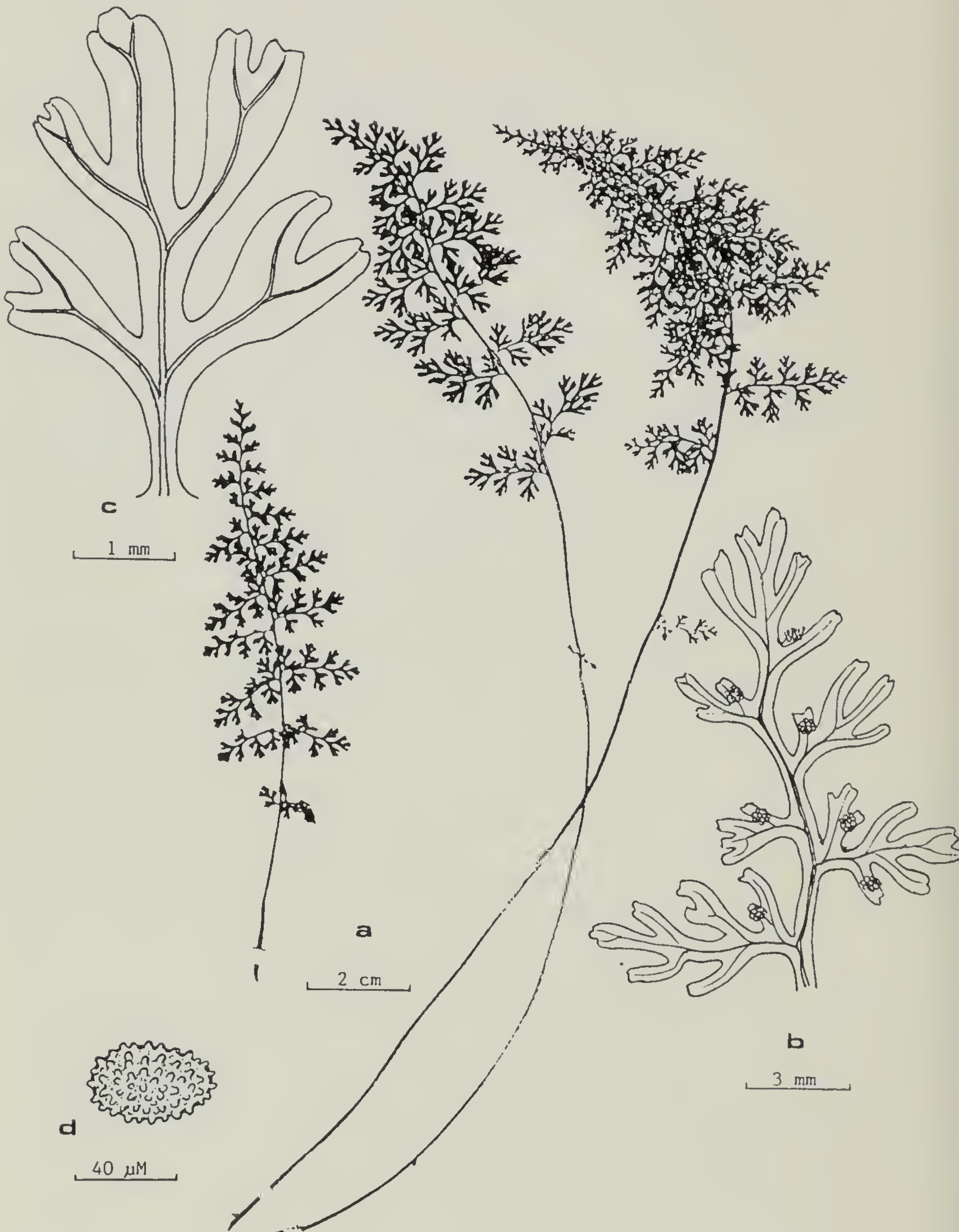

FIGURE 1
Backhouse's specimens of *Cystopteris fragilis* var. *alpina* from Upper Teesdale.
a. Silhouettes; b. Pinnule; c. Pinnule segments showing vein-endings; d. Spore.

"like little hedgehogs" and more distinctly echinate than those of *C. fragilis* and its variety *dentata*. Jermy and Harper (1971), however, state that the spores of *C. regia*, originating from Cimolais, Italy, had short blunt spines, but their illustration (p. 212) shows that they were not quite so short as the tubercles of the Teesdale specimens of var. *alpina*. The spores of the Teesdale plants therefore appear to be distinctive in having very short blunt tubercles, but on the assumption that the illustrations (Plates CI and CII) in Moore (1860) are accurate, then they are not unique in this respect. Clearly, the numerous varieties of *C. fragilis* need to be re-collected and their spore type compared to establish whether these characters can be used meaningfully in their classification.

Spores of the Teesdale var. *alpina* have been measured by R. H. Roberts and compared with other members of the *C. fragilis* complex. However, due to the great age of the Teesdale specimens it is not certain whether additional shrinkage in their spores during drying and ageing has occurred and therefore whether their size is strictly comparable with the other measurements which were all made on recently collected material. Additionally, only two separate gatherings of typical *C. fragilis* were included and this sample may therefore have been inadequate. The spores were mounted in gum chloral for 24 hours and the exine (exospore) measured using a magnification of *c*. x 900 with a calibrated eye-piece micrometer (Table 1).

TABLE 1

Cystopteris Spore Dimensions

The *C. fragilis* var. *dentata* samples were taken from four widely separated gatherings in the Central Scottish Highlands, the typical *C. fragilis* from two localities, and the remainder from a single location. Spores not fully developed were not included in the measurements.

Taxon	Locality	No. in Sample	Exine Length (μm) Range	Mean
C. *dickieana*	Type locality	20	41-48	44
C. *dickieana*	Perthshire, VC88	60	39-47	43
C. *fragilis* (typical)	Scottish Highlands	40	40-55	48
C. *fragilis* var. *dentata* Hook.	Scottish Highlands	80	38-49	43
C. *fragilis* var. *alpina* Hook.	Seefeld, Austria	20	44-54	49
C. *fragilis* var. *alpina* Hook.	Upper Teesdale, VC65	18	37-46	41

Discussion and Conclusions

Further work on the spore type of the *C. fragilis* complex is certainly desirable. It would have also been useful if the chromosome numbers of the taxa discussed had been available. Jermy and Harper (1971) stated that *C. regia* from Cimolais, Italy, was hexaploid and suggested that there may be a correlation between the chromosome number and the spore characters, as well as the degree of dissection of the frond (Jermy *pers. comm.*). Jermy and Harper (1971) further state that R. F. Blasdell had shown earlier that spore size in *Cystopteris* increases with increasing chromosome number. The spores of the Teesdale specimens of var. *alpina* were the smallest of all the samples measured, whereas in contrast those of the Seefeld var. *alpina* were found to be the largest. It is reasonable to assume that any additional shrinkage which may have occurred in the spores of the Teesdale specimens has been marginal and that originally they were possibly no larger than those measured of *C. dickieana* and therefore still significantly different in size from the spores of the Austrian var. *alpina*. A differing chromosome number maybe one possible explanation for this discrepancy.

The only certain native British example of *C. fragilis* var. *alpina* appears to be long extinct in its original Teesdale locality and no further sites have been discovered. J. Backhouse Jun., however, owned a plant nursery in York which specialised in ferns. A herbarium note on one of his sheets of specimens in herb. E confirms that he had the Teesdale fern in cultivation as early as 1872, and as he controlled the nursery until his death in 1890 it is certain that he would have distributed it widely. There is therefore some possibility that it still exists in cultivation in Britain today, and perhaps may be recognised by its distinctive spores.

Acknowledgments

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BOOK REVIEW

Lichens on Trees: a guide to some of the commonest species by **Alan Orange**. Pp. 48, illustrated throughout. National Museum of Wales, Cardiff. 1994. £3.50.

This handy booklet, number 3 in the National Museum of Wales' British Plant Life series, is both attractive to the eye and an authoritative introduction to those lichens commonly found on trees throughout the British Isles in areas where the air remains unpolluted or at least relatively so. Excellent half-page colour photographs (most of them taken by Peter Russell) for 39 species are complemented by informative supporting text plus the author's own superb line drawings highlighting certain features important in identification. Introductory notes are provided on structure, reproduction, ecology, effects of pollution, studying lichens and further reading, accompanied by four habitat photographs. A useful and very well produced booklet which can be confidently recommended.

MRDS

'THE HAW': AN EIGHTEENTH CENTURY GREENFIELD SITE NEAR SKIPTON

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Introduction

Extractive and construction industries on 'greenfield sites' are likely to both destroy and create habitats for spontaneous colonisation by plants. This paper is an attempt to recognise both processes through retrospective study of an area of about 3km² where large scale commercial quarrying, and railway construction, began during the nineteenth century.

'The Haw' (Old Norse 'haugr' meaning 'hill'), just north-east of Skipton, was once an elongated hill (Fig. 1), with an east/west ridge (NG SE0052 and SE0252). The integrity of the ridge was evident on OS maps published before 1957. However, on recent maps a large part of the hill is represented by a blank (Fig. 2b) indicating that its topography is in a state of considerable flux, as a result of limestone quarrying, infilling, and the creation of spoil heaps and embankments.

In view of this flux, it is of interest to assemble evidence of the landscape(s), vegetation and floras of the past whilst remnants of the hill still remain (Fig. 3). A review of these matters, in which the hill is set in its plant-geographical context, may be of value during eventual rehabilitation of the land.

Throughout this account The Haw is used, as it has been in recent oral tradition, to describe the hill between road and railway (Fig. 2). This usage does not correspond with that on old Ordnance Survey maps where The Haw was associated only with a triangulation point at about 251m OD. 'Hawbank' and 'Hawbank Rock' are names associated with steep slopes at the western end of the hill.

The bedrocks of 'The Haw' are hard, dark limestones and calcareous shales. The main outcrop of Carboniferous limestone of the Craven area is to the west. Skipton and 'The Haw' lie at the root of a narrow tongue (the Skipton Anticline), 3 kilometres wide, of outcropping limestone with shale partings, which extends eastwards to just beyond the River Wharfe. A low-lying outcrop just to the east of The Haw is the site of a quarry (at Halton East), whilst a few kilometres further east Hambleton Hill is the site of yet another quarry – once with a water-filled 'dub' – now disused and infilled. According to Smith (1962) the original name (Hameldunle) recorded from the twelfth century suggests a 'mutilated or scarred hill'; it illustrates the long history of limestone quarrying east of Skipton. About 1km to the south is 'Wheelan Rock', a small abandoned quarry. The quarries are separated from each other, and from the calcareous Craven uplands, by featureless drift slopes and drumlins bearing mainly neutral (*sensu* Tansley 1949) and improved grassland.

The areas on the anticline available to calcicolous plants of grassland and rocky habitats are thus rather small, and largely anthropogenic; their isolation must hinder the immigration of such species from the Craven uplands, and has affected the likelihood of re- establishment of any species lost through post-glacial afforestation or through human activity.

This account has been based largely upon secondary sources of information, including maps, historical/antiquarian works, local floras, and oral tradition, together with the writer's own field observations.

Pre-History Glaciations and Wildwood

There is no doubt that The Haw would have been forested in post-glacial times, and that it is south of the limit of the last (Devensian) glaciation (Penney 1974). It would thus have been available for colonization by a calcicolous herbaceous flora, including arctic-alpine species, during the Devensian period. Eventually, when the British Isles became suitable for tree growth around 11,000 BC (Rackham 1986), The Haw may have lost such species. It seems likely that the drift material of earlier glaciations would have supported wildwood,

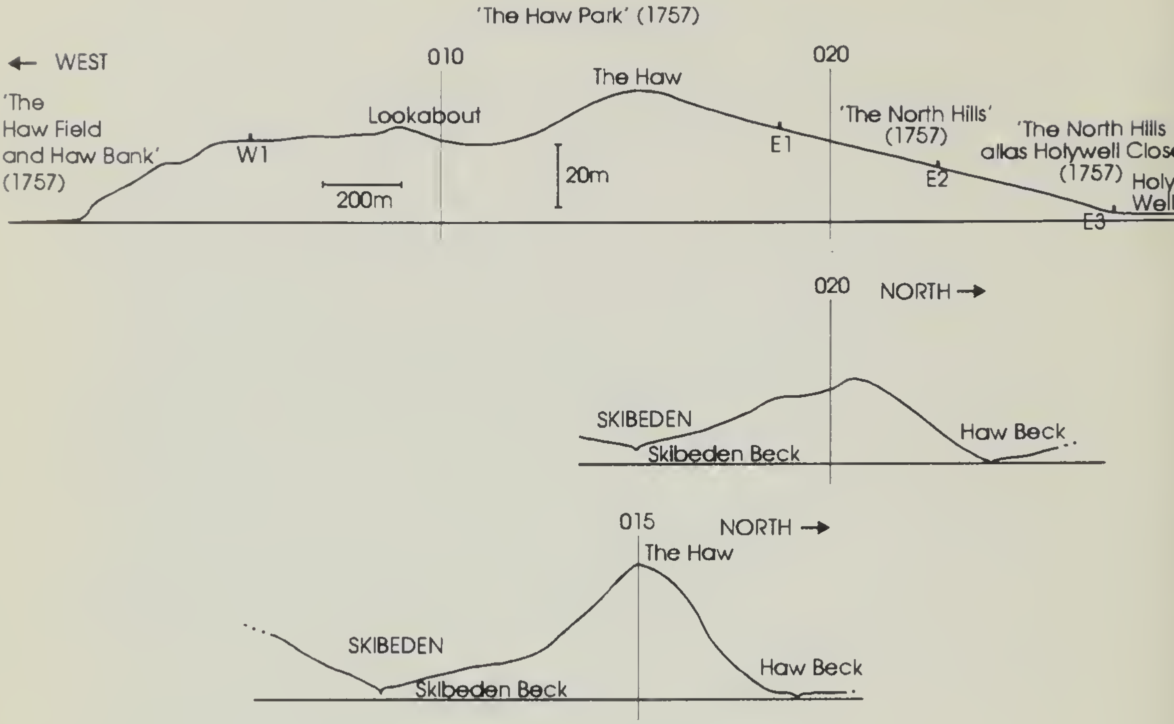


FIGURE 1

Past profiles through The Haw. '1757' relates to names (as spelt) of land parcels shown on Fig. 4. the topmo profile is on a line running through the two peaks at a bearing of E 19°N. W1 and E1 mark the walls boundi the Haw Park', and E2 and E3 mark other walls shown on Fig. 4; 'The Haw' is here applied to the highest p d the datum is at 500 ft (152m). Vertical lines correspond to eastings of the 100km National Grid in square

and that only in the vicinity of a crag, of which 'Lookabout' (Fig. 1) may be a diminished and quarried relic, might any part of The Haw have escaped afforestation. The likely local dominants of the wildwood would have been Ash (*Fraxinus excelsior*) and Hazel (*Corylus avellana*).

Clearance of the wildwood of Craven must have begun in Neolithic times, from about 4000 BC, and have been largely accomplished within about 2000 years. According to Smith (1962), the 'rarity of woodland terms in the place names of Craven' suggests this, but 'the place-name evidence is indecisive as to the extent to which Craven was peopled in pre-English times'. Stress-tolerant ruderal herbs and arctic-alpine species from clearings and unforested crags, screes and limestone hilltops of the Craven uplands would more easily recolonize small marginal limestone outcrops as the wildwood was destroyed. These matters will be taken up in a subsequent paper.

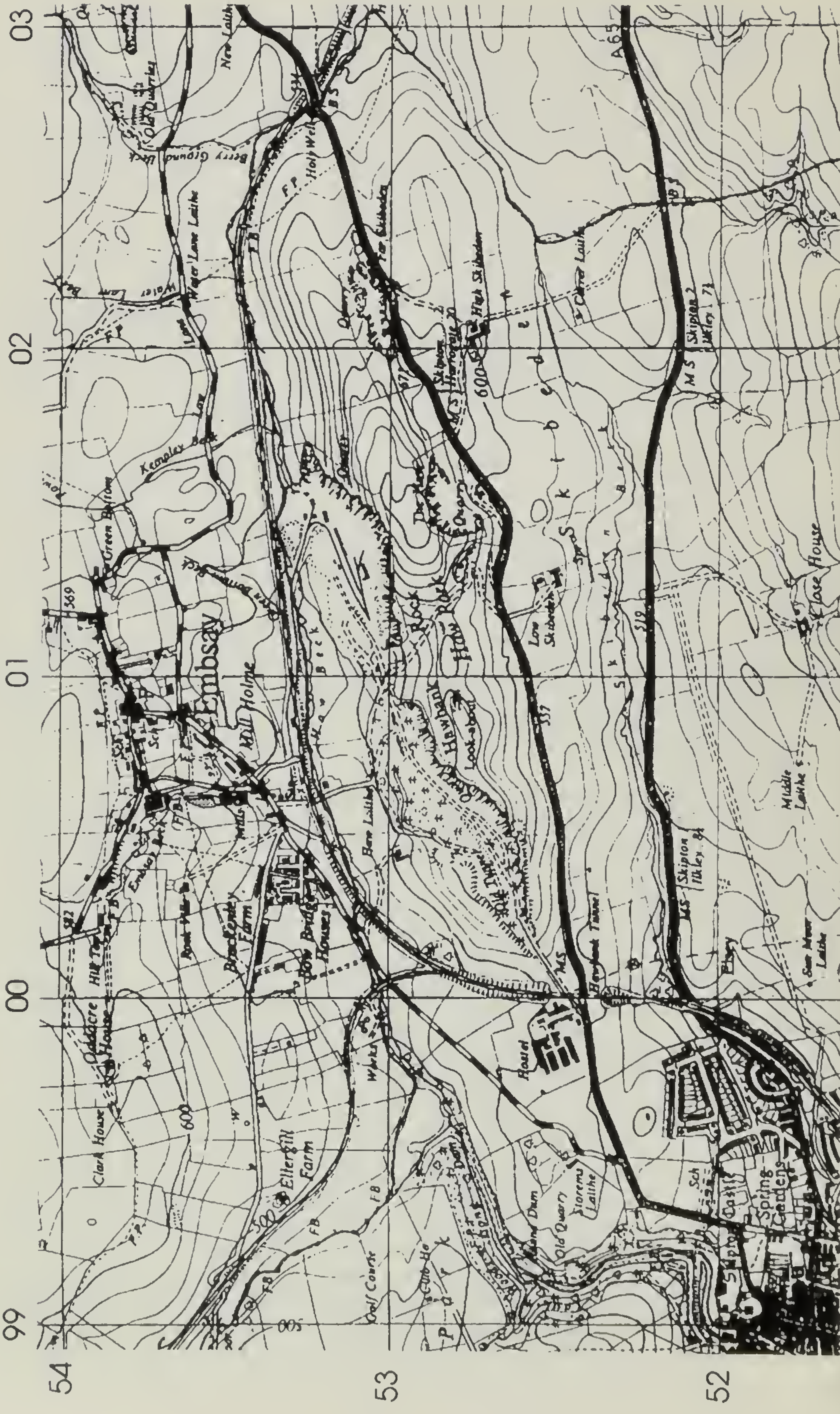
Places on The Haw

References to the geography of the hill in antiquarian literature are imprecise, but the 'greenfield site' is conveniently recollected here by the use (in quotation marks) of numbers and names for pieces of land, on and around The Haw, quoted by the eighteenth century surveyor James Crow (Crow, unpublished 1757), on his Plan of the Manor of Skipton; many of the field boundaries shown correspond exactly with those on 19th and 20th century O.S. maps. The drawing (Fig. 4) is based on part of Crow's Plan. Only recently, with the completion of the Skipton bypass in 1982, has the road system around The Haw come to diverge confusingly from that of the 18th century (cf. Figs. 2 & 4).

TABLE 1

Abridged material, with original spellings, from 'A Field Book . . .' (Crow 1757)
'The Letter put against each Tenants name in the Book refer to Like Letters . . . in y Plan. The Series of Numbers in the first Column refer also to Like Numbers in the Plan . . . the Quality of each piece is shown by the Letters A, M, P, & W denoting Arable, Meadow, Pasture or Woodland . . .'. [*Py* = partly]

Land in Hand	A	
4	Nearer Storam	M
5	Middle Storam	P
6	Further Storam now in two parts	P
10	Storam Close formerly called Park Close adjoining Storam	M
11	Crofs Bank Clofes in two parts at farther End of Storams	P
12	The Hawfield Meadow in which is a Lime Kiln	P or M
William Howson	K	
74	New Close	P or M
75	New Close Meadow	P or M
Thomas Chamberlain	L	
296	The Haw Park the greatest part of it is woody pasture	P
John Mitchel	P	
313	The House Barn Stable and Yard and Skibeden Field adjoining	P
314	Crabtree Croft and Fagg Field lying together	M
317	The East Field	P
318	The Haw Field and Haw Bank lying together Exclusive of Burlington piece lying with it called Hedge Peigh Hill	P
John Heelis and William Mitchel	Q	
319	The House Stable Yard Garden & two closes below the House	M
320	The Close above the House & Kiln Field lying together	P
321	North Hills in which is a Barn about $6^{A}1^{R}00^{P}$ is woodland	A Py woody
Edward Heelis	R	
326	The House Barn Stable Yard Garden, and the North side Close in which is two Lime Kilns	P
327	The North Hills alias Hollywell Closes formerly in four parts	P
328	The Close before the Door in which is a Barn	A & M
329	Anr Close before the Door adjoyning the Last	P
330	Upper and Lower Merry Platts alias Sunny Sides	P
William Walsh	S	
333	The House Barn, Stable Yard and the Close before the house	P


03
02
01
00
99
54
53
52
Embsay
Mill Holme
Kembley Beck
Green Bottom
Haw Bank
Hawbank
Low Skibden
High Skibden
Close House
Middle Laithe
Skipton
Spring Gardens
Castle
Clark House
Eller Gill Farm
Golf Course
Old Quarry
Storems Laithe
Hawbank Tunnel
Close Laithe
Bow Bridge Houses
Bow Laithe
Hill Top
Oddacre House
Berry Ground Beck
Water Lane Laithe
New Laithe
A65
Skipton 2 Ilkley 7½
Skipton Ilkley 8¼

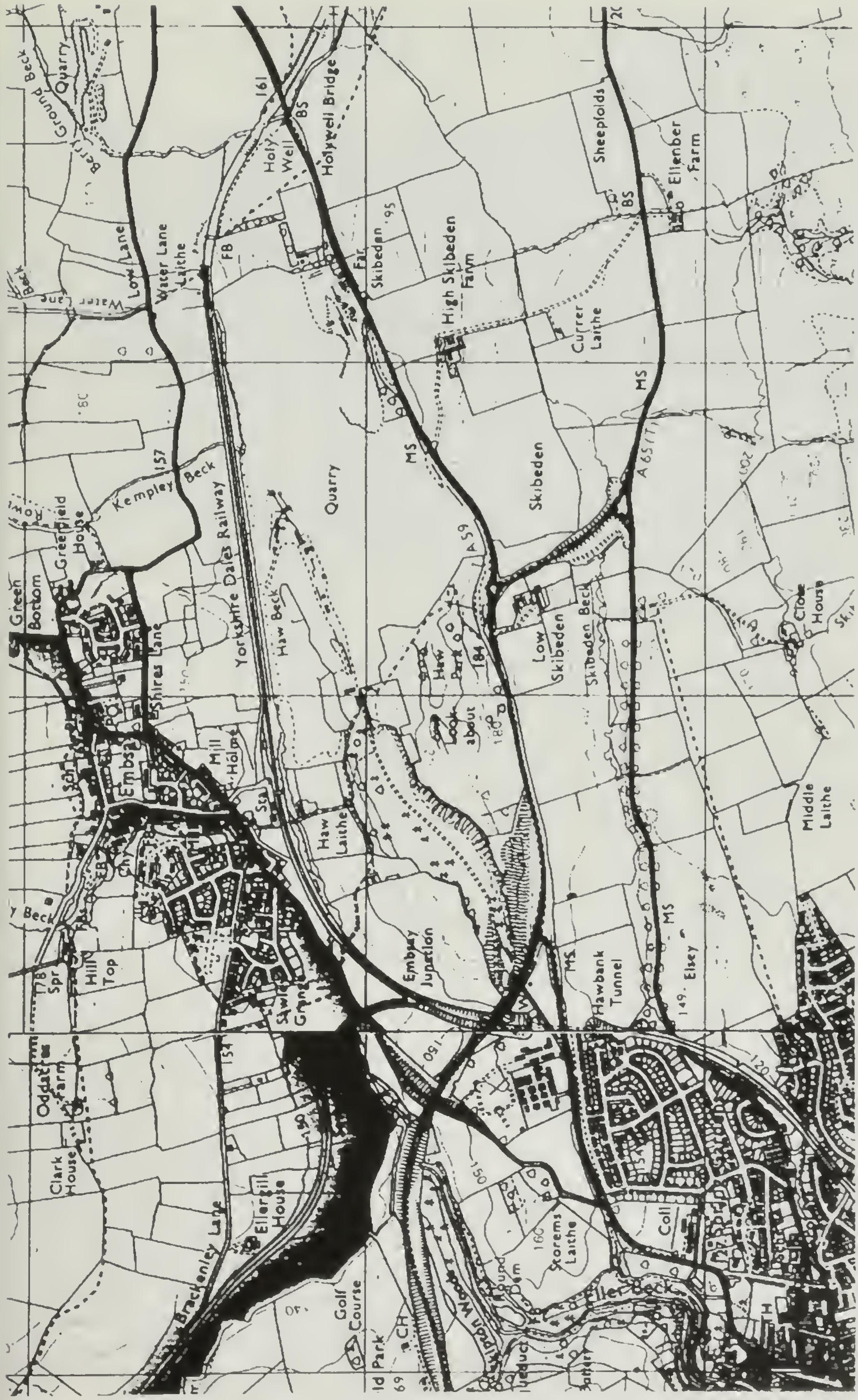


FIGURE 2

'The Haw' and its environs reproduced with permission from 1:25,000 Ordnance Survey maps: (a, above) from sheets published in 1957; (b, below) from sheets published in 1983-4. 1km NG squares (within 100km square SE) provide location and scale. The dark area above line N53 represents the perimeter of the Dales National Park. © Crown copyright.

FIGURE 3
The cleft in The Haw in 1989. Looking south from NG intersection SE015535. The railway is below the level of the field; Skipton Rock Quarry excavation is behind the spoil bank; the vertical shale bed beyond (capped by remains of the southern slope of 'The Haw Park') screens Skibeden Quarry.

Not all of Crow's names are in local use today, but, in conjunction with his Field Book (quoted in Table 1) they provide precise reference to fields and land use over two hundred years ago. The only name still appearing on maps is 'Haw Park' ('The Haw Park' of Crow); this refers to the largest parcel of land on the hill, but the varied dimensions of the name on O.S. maps, from the middle of the 19th century to the present, reflect successive cartographers' perceptions rather than historical accuracy or modern local usage; thus on the first 'six-inch' (1:10560) O.S. map of the 1854 the label far transcends Crow's eastern boundary – extending through his pieces 'Q321', and 'R326' into 'E327 . . . Holywell Closes' and disregarding the intervening dry-stone walls; here also the apparent western boundary had been moved, representing a new wall some 300m to the east. On later maps the name diminishes – ultimately (Fig. 2) into a tiny unquarried area in what was the south-east corner of the park in 1757; the name survives *in situ* today as that of a modern dwelling – 'Haw Park House'.

Early History: To Mid-Eighteenth Century

References to early colonisation of the Craven region, and to the growth of Skipton (first referred to in the Domesday Book of 1086) a short distance to the west of The Haw, are supplied by Williams (1987). He comments that 'it is unlikely that the village could have been founded before the seventh century AD' when 'the area was gradually infiltrated by Anglo Saxon settlers . . .'. Subsequently, by the time of Domesday, a Viking population must have been superimposed on the English one. The name is 'Scandinavianised Old English' meaning 'sheep farm'. Sheep farming has evidently been established in the area for at least 1,000 years, and Williams (1987) remarks that there was suitable pasture on the lower hill slopes for the sheep of the early settlers. The valley of the Skibeden Beck, and thus the southern slope of The Haw, was obviously so used, as the name 'Skibeden' suggests 'sheep-valley', or 'sheep hill'.

'[T]he Manor of Skipton, in which The Haw lies was said to have an area of twelve carucates in 1284' (Whitaker 1878), while at Embsay a Celtic monastery established before the seventh century had encompassed, by 1086, six carucates; the derivation of 'carucate' from a word meaning 'plough' is suggestive of arable farming all around The Haw in the eleventh century. Evidence of ridge and furrow ploughing can be found in modern pastures around The Haw, and lynchets are present on the north-facing slope of 'R318 The Haw Field and Hawbank', indicating that this land (which was pasture in the 1750s) was arable in the Middle Ages, or even earlier (see Rackham 1986).

In Skibeden there was farming activity apart from shepherding in the thirteenth century, and there is reference to a wood – presumably on The Haw. A quotation by Dawson (1882) from a valuation exercise of 1609 indicates that only two 'tofts' (homesteads with overhanging tufts of trees) were present in the valley; these would have been largely self-sufficient crofts still present in Crow's time – probably on the sites of High Skibeden and Low Skibeden (Fig. 2).

On the north side of The Haw there is an enclosed pasture referred to by Crow as 'the Burlington piece' and as 'Hedge Peigh Hill' (the Field Book) or 'Hodge Teigh Hill' (the Plan). Hedge could here have its modern meaning, but its alternative, Hodge, may be a diminutive of Roger. Pigh(t)el represents a croft or small enclosure in Middle English (Smith 1962). It is therefore likely that some domestic cultivation was carried out here in medieval times, and that 'Hodge Peigh' (used hereafter) is an appropriate combination. Enclosure of this plot evidently preceded the walling of The Haw Park as Crow's Plan shows a more ephemeral boundary (a hedge or pale?), and The Haw Park wall diverted to accommodate it. The dry-stone walling around the croft was made complete with a poorly constructed western wall sometime after 1757. The present grazed, species-poor grassland of the plot is probably not 'ancient'.

The area above 150m appears (from aerial photographs) to have escaped the plough. This elevated area was never likely to have been regarded as useful for non-woody crops, and in medieval times it constituted all or part of a deer park. The first record of Haw Park dates from 1257 (Williams 1987). It first belonged to the de Romille family who built the original Skipton Castle around 1090. Such parks were for provision of venison rather than for hunting (Rackham 1986), and 'were one of the causes of loss of woodland'. Here, however, relict wildwood rich in hazel might have remained.

The earliest boundary of the park may have been a pale such as described by Rackham (1986). The antiquarians who have mentioned several small parks around Skipton have all omitted this detail. None has defined their boundaries, or revealed when the parks fell into disuse, although Whitaker (1878) suggested that the whole of a six-by-four miles 'Forest of Skipton' was enclosed by a pale in Norman times. The term Forest, in this contest, does not mean woodland (see Rackham 1986); it would suggest a large area ranged by Red Deer (*Cervus elephus*).

Palisade boundaries, rather than walls, were suggested pictorially around two areas near Skipton Castle on Saxton's (1577) Map of Yorkshire (Fig. 4 inset), and in evident plagiarisations by Speed [Speede] (1610). One of these enclosures could have been that on The Haw, The boundary of 'The Haw Park' was sharply delineated by Crow (1757); his lines represent dry-stone walls, completed by 1612 (see below), and present as fragmented relicts today. A few metres of the eastern wall (Fig. 2a) are now left between Haw Beck and an overwhelming heap of quarry spoil, and short lengths are left along the A59 road.

Although a park keeper 'at Hawe' was employed in 1609 (see below), Rackham's (1986) conclusion that deer parks went out of use in the 16th and 17th centuries is probably applicable. The enclosure of the common fields of Skipton with walls had taken place before 1612 (Hey 1986) and the walls around The Haw Park are likely to have been built at the same time, to replace a decaying pale. The remaining fragments are low; the walls were not necessarily in the same place as the pale, and were probably only intended to confine sheep.

There were uses for Haw Park apart from grazing: records of these provide the only

FIGURE 4

Drawing based on part of a coloured 'Plan of the Manor and Lordfip of Skipton in Craven . . .' (Crow 1757). Skipton Castle is represented on the extreme left. Original scale = 5 chains to one inch: here 1km NG squares (within square SE) are superimposed. Original spellings are adhered to. Insets (not to scale): top based on a fragment of Saxton's (1550) map; bottom based on a fragment of Thomas Jeffereys' (1775) map.

evidence of the pre-19th century flora. Firewood and nuts mast have been important crops on the hill; in 1302-3 a castle warden's accounts included '2s for nuts in the wood of Scrybden' (Cox 1907); and in 1327 certain tenants at Skibeden were paying 'two-pence yearly . . . for being quit from gathering Nutts in the wood called the Hawe . . ." (Dawson 1882). A valuation of the Manor of Skipton dated 1609 (quoted by Dawson 1882) refers to 'The Customes seruices, & other monies paid by the Tenn'ts of the tofts & grounds there . . .' [at Skybden]; these included '. . . for nutts at Hawe ijs" [two shillings]. '. . . Nutt'g at Hawe . . .' is mentioned in yet another valuation dated 1612 (Whitaker 1878). Hazel had presumably grown well on the Skibeden side of the hill for at least the previous three centuries, and might well have been encouraged on the hillsides from Mesolithic times (see Rackham 1986). It appears to have suffered a decline in local production by the 18th century as no appropriate woodland is suggested by Crow's Field Book. Hazel (a nationally threatened native species – see Rackham 1986) is now present only in small quantity marginal to the A59 road, and has been recently planted on northern spoil slopes.

In 1311 '. . . wood sales . . . in Haw were five shillings . . .' (Williams 1987) and the valuation of 1609 shows that tenants at Skybden brought '. . . pine wood, and maw hey [mown hay] to the Castle . . .'. This is consonant with an earlier (see Carlisle & Brown 1968) introduction of Scots Pine (*Pinus sylvestris*) on The Haw. Symbols on Crow's Plan suggests that pine trees might still have been present in 1757.

The Clifford family took over Skipton Castle and its lands in 1309 (Dawson 1882); they 'took every precaution to preserve . . . [the] . . . fallow deer within the several small parks' (Cox 1907), and the household book of the Cliffords for 1609 records an expenditure of 15 shillings thus – 'Kep'ship at Haw in p't xvs' (Whitaker 1878). According to Rackham (1986) it was 'common practice to graze cattle or sheep in parks, to let grazing to local farmers and to sell hay'; wood was also gathered. 'Haw Parke and Haw Bancke' were let for £56 in 1652 (Dawson 1882): this 'was just a fair sum . . . for pasturing sheep' (Dickinson 1987). Sheep may, by this time, have completely replaced fallow deer (*Cervus dama*) on The Haw, and the run-down of the park first to a 'woody pasture' (implied by Crow's (1757) Field Book), and later (through immigration of Hawthorn) to the 'bushy pasture' recorded by Whitaker (1878). This is in accordance with Rackham's (1986) observation that especially in the 16th and 17th centuries parks went out of use. Today, any grazed fragments of the park outside the blank area of O.S. maps (Fig. 2) bear swards, rather than tussocks. Records extracted form Crow's Field Book (Table 1) show that almost the entire area between the two east/west becks was pasture in 1757.

Dwellings and Laiths on The Haw

Records of buildings (Table 1) illustrate 18th and 19th century pastoral activity on the 'greenfield site'. A large roadside barn was recorded by Crow, on the southern slope, in 'Q321 The North Hills' near the present layby (NG SE010530). It was not shown on the 'six inch' O.S. map of 1854, but a 'new' storage building 'Haw Lathe' was shown within a new enclosure on the northern slope of The Haw Park. Later buildings reflect changes in land-use. One, represented on the 'six-inch' O.S. map of 1854, was within the entrance to Skipton Rock Quarry. It is labelled variously on later maps as 'Rock Cottage' or 'Rock House'; on the 1:10,000 O.S. map of 1985 an unlabelled rectangular outline (NG intersection SE003526) represents its remains. It was inhabited (althought without services or running water) until about the 1940s, and was a motor-cycle workshop in the 1960s. A third dwelling was present for some time during the first half of the present century, on the site of the present TILCON offices, east of a right-of-way crossing the present access road to Skipton Rock Quarry.

On the northern slope (near NG intersection SE004530) is Manby Castle House, a converted row of cottages built in the late 19th century, in 'The Burlington piece' or 'Hodge Peigh Hill', and a few hundred metres to the north-east the late 19th century engine house of the quarry has been converted to a dwelling. On the southern slope Haw Park House stands on the site of 'The Bungalow', an early 20th century dwelling shown

within the western arc of an old quarry on, for example, the 'six-inch' O.S. map Revision of 1938.

The southern slope of The Haw, rather than an entire valley, constitutes Skibeden; here, apart from two dwellings south of the road, Crow indicated a house and outbuildings at the northern roadside (Fig. 4) in 'R326 North Side Close'. This site became that of quarry offices (removed in 1991). It is labelled 'Far Skibeden' on recent maps, and remains of the eastern wall of 'R326' approach the A59 road a little to the east. A modern house and livery stables are now present further to the east in 'R327 The North Hills Alias Holywell Closes'.

Topography and Water

Reconstructions of the topography as it was before quarrying or railway construction are shown here (Figs 1 & 5). Much of the original land surface of The Haw has been lost through extensive quarrying and the eastern end now appears as two barren, and diminishing, rocky humps (Fig. 3).

The highest point, at a little over 215m OD, was towards the eastern end of the ridge. This was gone by 1960 when the skyline was breached, but 'Lookabout' (or 'Look-about'), a crag of exposed limestone near the western end, remains at about 230m. The name may reflect Victorian romanticism.

A railway, constructed in the 1880s, abandoned in the 1960s, and partially restored in the 1970s as the Yorkshire Dales Railway (Dickinson 1987; Smith & Binns 1986), runs along the northern base of The Haw at a height of around 152m, and a road (the present A59), the course of which predates Crow's Plan, runs along the southern flank at somewhat higher levels (above 183m at its highest point); although these anthropogenic boundaries define the area to be studied in detail, the true topographical boundaries (see Figs. 1 & 2) are two tributaries of the River Aire: – Haw Beck alongside, and mostly south of, the railway, and Skibeden Beck running parallel to the A59 road but some hundreds of metres from it across improved grassland to the south. Both of these streams flow to the west. Haw Beck is fed mainly by tributaries from hillsides to the north.

The Haw slopes gently away eastwards and is bounded by a watercourse, the Berry Ground Beck (which becomes the Holywell Beck), flowing south-east to the River Wharfe; Berry is possibly a corruption of an Old English word: either 'werig' referring to 'wretched' marshy ground which still exists in the vicinity or 'wella' implying a well or spring. At its eastern end Haw Beck flows through a small area of marsh just south of the railway (Fig. 2b) fed by Water Lane Beck, and by run-off from The Haw.

Wetland adjacent to Haw Beck is of limited extent today, and some is anthropogenic; for example, a small rectangular shallow pond created for quarrying purposes during the present century is present at around 155m OD in the NW corner of 'R321 The North Hills' (Fig. 4). The watercourse has, in parts, been straightened and contained alongside the railway (cf. Figs. 2a & 2b), and there was evidently much more marshy ground alongside a more irregular watercourse in earlier times.

Drainage of The Haw when it was comparatively intact was by surface run-off and through groundwater seepage. The seepage provided springs (Fig. 5) sometimes recorded by map-makers, and at other times overlooked. These were on the northern flanks and at the extremities of The Haw at around the 525ft (=152m) contour; below this level, ground water, unless pumped out, floods the more recent quarry workings which descend to about 143m OD east of the E02 NG line. On the 'six-inch' O.S, map of 1854 a spring is recorded at about 152m – the source of the only mapped (*c.* 100m long) tributary flowing from The Haw into Haw Beck. It joined the latter in NG square SE011531, and is not marked on the 'twenty-five inch' O.S. map of 1889, surveyed after the railway was completed. It is suggested here that below the 500ft contour the area around this inflow into Haw Beck from the south, and those of Green Bottom Beck and Kempley Beck from the north, must have been swampy, providing a habitat for marsh plants.

Holywell, at the eastern end of The Haw, would have originated as a spring. Such a

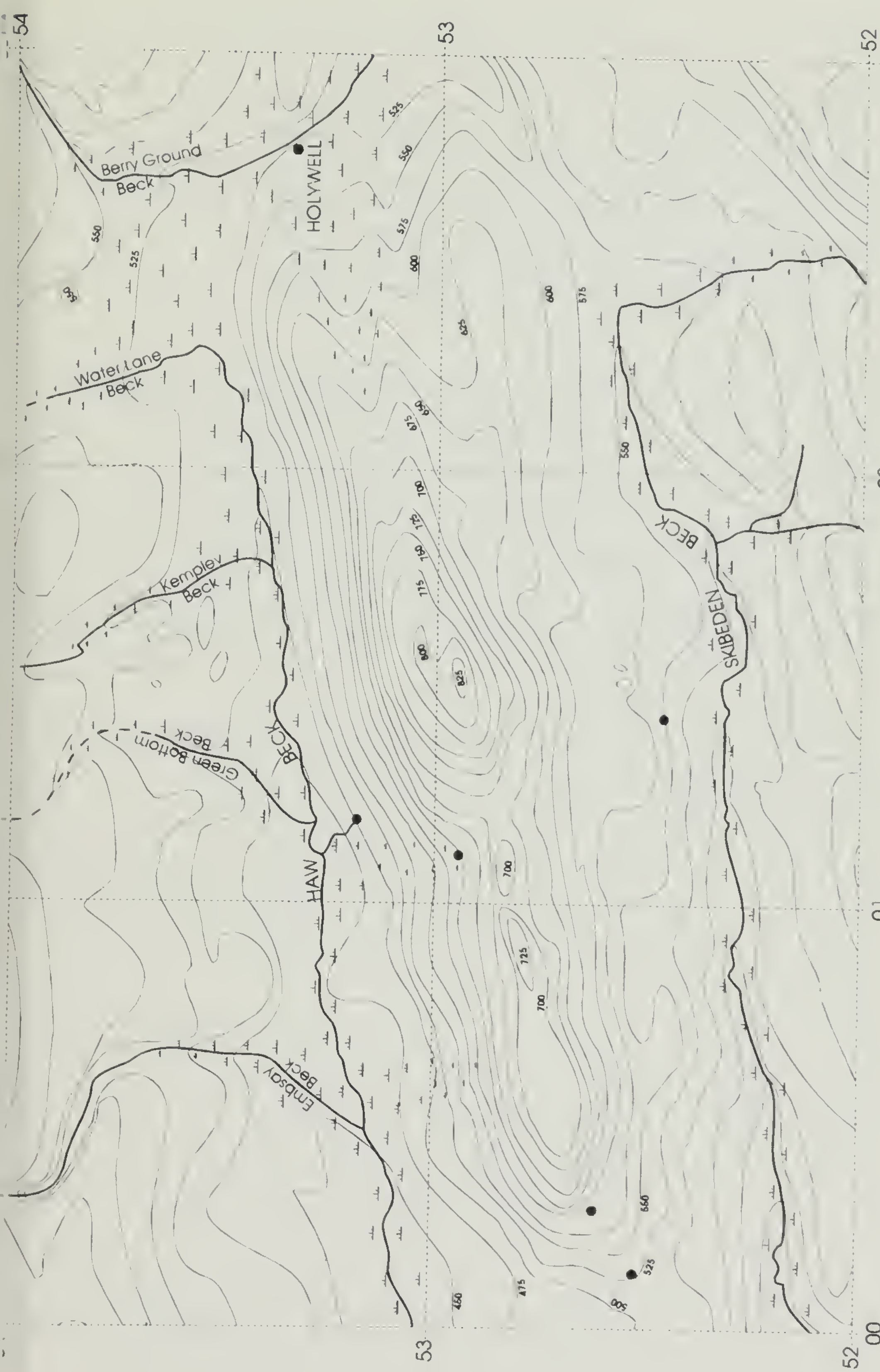


FIGURE 5

An approximation of ancient topography. Contours (in ft above OD) extrapolated through quarried areas. 1km NG squares are superimposed. ● = the position of a spring or well. The easternmost ● represents a spring at 525ft (125m) OD, that became a well sometime after 1757; a little to the east of this a nineteenth century well, also at 525 ft OD within quarry workings. Locations of ancient wetland and flushes are suggested.

spring, at around 152m OD, was recorded by Crow (1757) at the western end of The Haw. This had become a well by 1850, but was probably not the water supply for Rock Cottage, as an additional well is indicated on the 'six-inch' O.S. map of 1894 adjacent to the building – again at the same level, but within the oldest Hawbank quarry workings. Other springs have been observed on The Haw: one providing drinkable water in the 1930s, is recalled by Mr E. A. Higson (*pers. comm.*) at around 152m OD just north of the access road to Skipton Rock Quarry; the road floods here occasionally.

Another spring is marked much higher on the northern slope west of Lookabout, at around 200m, on the 'twenty-five-inch' O.S. map of 1889 but on none of the other maps consulted. There is seepage here today (near NG intersection 0153) and a tiny streamlet has carved a discontinuous channel in the grassland; nearby, to the east, water with a pH of 8.2 gathers in several swamp areas on spoil (each <25m^2) adjacent to a quarry track leading to the ridge.

Spoil and Soil

The natural soils of The Haw comprise both drift material and autochthonous elements. Where a long-undisturbed land surface remains, the soil is mostly 'Brown Calcareous Soil' *sensu* Curtis *et al.* (1976); it can be a metre or more in depth over fragmented iron-stained limestone. Spot records of pH of the rooting zone of grassland soils on The Haw have varied between 7.2 and 8.2, but pH values as low as 6.4 have been recorded from the easternmost extremity of the hill (NG SE016543). The exposed limestone of the Lookabout crag bears pockets of shallow humic soil, and downhill, particularly to the north, scree fragments constitute a major part of the upper soil layer.

Unstratified soils derived from the overburden and spoil of quarrying comprise the surface layers of waste heaps and embankments over much of The Haw, and pH values of 7.6 are typical. The properties of some quarry spoil are such that surface water tends to persist in hollows wherever a nearly level surface is available. It is deficient in plant nutrients (Hambler *et al.* 1990).

Where the bedrock has been exposed for twenty years or more, as in the old Hawbank workings and in a very small, ancient shallow quarry a few hundred metres north west of Holywell, thin, black humic soil is present.

The water of Hawbeck was of pH 7.98 on 15th November 1993 whilst that of the mud of the adjacent pond was of pH 7.43. This pond, in the north west corner of 'Q321 The North Hills' just south of NG intersection SE018534, was created in the 1960s, for quarry purposes, at the foot of a spoil bank; the pond and an 'untouched' marshy area nearby, between Haw Beck and the railway, have provided a continuity in the availability of circumneutral marshy habitats alongside The Haw from ancient times.

Quarries and Kilns

Although no quarries are shown on the plan or indicated in Crow's Field Book, much small-scale quarrying had taken place locally before 1757; such quarrying, probably high on The Haw, would have been needed to provide material for the 17th century dry-stone walls, and lower down to feed lime-kilns adjacent to roads. The origin of 'Lookabout', as a natural crag, or as a primitively quarried outcrop, is not obvious.

A faint pencil graffito comprising the word 'Quarry' within a rectangular outline straddling the wall between 'Hawbank' and 'The Haw Park' may represent the first stages of planning for a Haw Bank Rock Quarry, whilst the Plan hung in Skipton Castle. Within two decades of Crow's survey enough stone was being removed at the western end of Hawbank to necessitate the use of a horse-operated tramway, and in 1773 the 'Earl of Thanet obtained Parliamentary powers for the making of a canal . . .' (Dawson 1882) to transport stone commercially from Skipton. Thus, around one hundred years after Crow's plan had suggested a relatively unblemished hill, the deep canyon of what had become known as Skipton Rock Quarry appears on maps in roughly the position suggested by the defacement of Crow's plan. It was illustrated (fancifully) in a line drawing by Bailey

(1852) who commented: 'In surveying this deep and awful chasm, you will perceive that the appliances of British industry and skill can not only level a mountain but actually sink it . . .'! The lowest level was however, as at the entrance today, at about 520ft (158m) OD (Dickinson 1987).

The Haw was traversed from north to south by four major boundaries in 1757. A century later an extra barrier had been constructed across the hill, cutting off the Skipton Rock Quarry from the eastern two-thirds of the hill; its southern end now remains as a band of rubble extending up the hillside (near NG intersection SE016526) east of the grassed-over embankment (see Fig. 2b) made, around 1982, during construction of the Skipton bypass. Later, other barriers were constructed to separate quarried land from the public; the 'twenty-five-inch' O.S. map of 1889 shows that the quarry had eaten right through Hawbank, and passed through a 'bottleneck' at the north/south right-of-way (see Fig. 2a) over The Haw. it had expanded to the north and south and was bounded to the east by a new irregular wall, remains of which still retain a quarry track. This track, parallel in part to the right of way, passes southwards over the ridge at NG intersection SE0153, and ends at the Skibeden Quarry (now being infilled).

Skipton Rock Quarry, by the first decade of this century, had devoured the western end of the hill to the north of the skyline; it had by-passed both 'Lookabout' and 'The Haw' summit. The smaller Skibeden Quarry containing Skibeden Limekilns was marked 'Disused' on the 'six-inch' O.S. map of 1854.

Further east, a number of very small roadside quarries are shown on this map; several, at Far Skibeden, were clustered around a group of buildings (in Crow's 'R326 The North Side Close'). These became 'Old Quarries' on the 'twenty-five-inch' O.S. map of 1891, Far Skibeden Quarry on maps published around 1970, and were 'Skibeden Quarry (disused)', around NG intersection SE020530 on the 1:10,000 O.S. map of 1985. By this time the original Skibeden Quarry had long been reactivated, and physically linked with Skipton Rock Quarry.

The disuse of the small quarries at the eastern end of The Haw continued at least until after the Second World War. However, by 1968 aerial photographs show that those next to the (A59) road were active and that some confluence had occurred, a confluence which had been dramatised by the destruction of 'The Haw' summit, and by blasting in 1960 to create a cleft (Fig. 3) between Skipton Rock and Skibeden Quarries. The Skibeden/Far Skibeden quarry confluence now constitutes a landfill site separated from the A59 road by deliberately revegetated spoil banks, and in one small roadside area, around grid line E020, by semi-natural vegetation of conservation value.

One further small 'Limestone Quarry' was shown on the 1854 map; this was on the southern slope, in the middle of Crow's 'R327 The North Hills . . .', at NG intersection SE024533; it was not shown on later six-inch maps and, by the 1980s remained as a small hollow with skeletal soil over exposed bedrock and calcicolous vegetation surrounded by ancient neutral grassland.

In addition to the Skibeden Limekilns there were other kilns on and around The Haw. There was a 'Kiln Field' south of The Haw Park in 1757, and, some 500m to the north-east, Crow recorded 'R326 The House Barn Stable yard Garden and the North side Close in which is two lime kilns' the site of buildings at 'Far Skibeden' (Fig. 2). The records link precisely (a) with Raistrick's (1965) comment that the '. . . optimum period of the kiln was probably 1750 to 1850 . . .', and (b) with later botanical finds.

Summary

Land-use changes on The Haw have been inferred from archival records, and from maps. Once an undivided landscape feature, it has been changed beyond recognition through quarrying and railway works. The pace of alteration to the topography and drainage has increased during the past two hundred years. It will be shown, in a subsequent paper, how the vegetation and flora have been affected by these changes.

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THREE PARSON-NATURALISTS FROM DURHAM

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The Parson-Naturalist Tradition

A significant figure in English science and the English Church for several centuries has been the parson-naturalist. Since the time of William Turner (*c*1508-1568) clergy have made a most formidable contribution to natural history in England (Raven 1947; Jones 1988). The best-known figures are perhaps John Ray (1627-1705), with whom, it has been said, "the adventure of modern science begins" (Raven, 1942), and Gilbert White (1720-1793), whose *Natural history of Selborne* (1789) is one of the most celebrated books in the English language (Mabey 1986; Foster 1988). However, the brightness of the reputations of these individuals should not blind us to that great host of other luminaries who have, to a considerable extent, made English natural history what it is today. They include botanists and ornithologists, geologists and entomologists; clerical naturalists have included specialists on spiders, molluscs, sponges, seaweeds and lichens. Some of them, such as geologists Adam Sedgwick (1785-1873), William Buckland (1784-1856) and Thomas Bonney (1833-1923) had permanent university appointments (Armstrong, in press). Others originally held academic positions, but were required, as was the tradition in earlier centuries, to renounce them on marriage: such was John Mitchell (1724?-1795) who was Woodwardian Professor of Geology at Cambridge for two years, but who later spent 26 years in the Yorkshire parish of Thornhill (Geikie 1918). Some, like John Stevens Henslow (1796-1861), combined both an academic position and parochial ministry; he was Professor of Botany at Cambridge as well as the much-loved Rector of Hitcham in Suffolk (Russell-Gebbett 1977). Some, like Gilbert White, used their long association with a single parish (and incumbencies of over 40 years were not uncommon in the eighteenth and nineteenth centuries) to make a special study of a particular locality. Others specialised in a particular biological group. There were men who formed and supported natural history societies and field clubs, those who built up museums, and those who edited county floras, often using their network of clerical colleagues to assist them. There are certainly Scots (including Scots Presbyterian) examples of the genre, and not a few Irish, but the tradition is distinctively an English one; Australian, New Zealand and other "colonial" representatives in many cases have been English by birth, training or temporary residence. Quite a number, including several parochial clergy, have achieved the high distinction of a Fellowship of the Royal Society.

Many parson-naturalists have seen their work in natural history as an extension of their work as a priest. John Ray (botanist, ornithologist, theologian) set out the notion that "design implies a designer" in *The wisdom of God* in 1692. These ideas were recycled, without full acknowledgement, by William Paley (1743-1805) in 1802 as the doctrine of "natural theology"; it would be from the latter that many nineteenth century ordinands came across these ideas. Indeed, Charles Darwin (1809-1882), who went up to Christ's College, Cambridge in 1827 intending to enter the Church of England priesthood, in later life recalled that his reading of Paley was virtually the only study from his Cambridge days that was to be of much use to him in his scientific career (Barlow 1958).

There were others with rather different, or at least more specific, agendas. Some sought to marry the geological record with the Mosaic record of Genesis (Gillispie 1959; Livingstone 1987). Many, after the publication of *On the origin of species* in 1859 attempted to demonstrate the falsity of evolutionary ideas; yet others tried to find a way of accommodating them.

Many parson-naturalists were the products of Oxford or Cambridge Universities. From the 1840s onwards some were Durham graduates. This article identifies three such individuals whose training in Durham in the 1840s and 1850s was rather similar, describes and compares their careers, clerical and scientific, and offers a brief comment on their

respective theological and philosophical views. (For a biographical account of a Durham parson-naturalist of a later generation, the Lincolnshire botanist E. A. Woodruffe-Peacock, see Seaward 1971.)

Durham University in the 1840s and 1850s

The University of Durham was founded by Act of Chapter, with the consent of the Bishop of Durham, William van Mildert, on 28 September 1831. The University was then constituted by Act of Parliament 1831-1832. The first students came into residence in 1833. Durham University was thus extremely young and small in the 1840s, with just a few dozen students. Originally founded with only one college (University), by the 1850s Bishop Hatfield's Hall and Bishop Cosin's Hall had been established. The objective was to cater for the large and expanding populations of the North of England, remote from Oxford and Cambridge. The University was strongly clerical, with most of the academic staff in Holy Orders in the Church of England: one of the aims was to produce a sturdy breed of northern parson!

Originally appointed Professor of Greek and Classical Literature, Dr Henry Jenkyns (1796?-1878), formerly of Catherine Hall, Cambridge, later moved to the chair of Divinity and Ecclesiastical History. He dominated the teaching of theology at Durham during the period in question; a number of sets of notes taken by his students still exist, and from these it can be seen that he keenly developed a modern approach (for his day) to biblical criticism. He was held in high esteem by his students. From the first, however, Durham paid due attention to scientific subjects, and a Professor of Mathematics and Reader in Natural Philosophy were among the foundation appointments. From 1835-1873 the Professor of Mathematics and Astronomy was the Rev Temple Chevalier, who, interestingly, also held the position of Reader in Hebrew, as well as having parochial responsibility for the parish of Esh, near Durham. Occasionally voluntary lectures on scientific subjects were also given: on at least one occasion, Dr William Cook, Reader in Medicine gave a series of lectures on William Paley's natural theology. (Much of the material in this section and the next is based on the *Durham University Calendar* [DUC], held in the Local Collection, Palace Green Section, Durham University Library).

Three Ordinands in Durham

There might be some question as to whether William Brown Galloway (1811-1903) should truly be described as a naturalist as the amount of fieldwork he did seems to have been limited, but his writing on what might be considered geological topics were so prolific and so typical of a particular genre that he is included here. Born in Glasgow, he received an MA degree from that University before coming to Durham, and indeed for a while he may have held a teaching position there in moral philosophy. He came into residence in Durham in 1839 and seems to have been quite competent academically, taking the junior Hebrew prize in 1840, and the senior prize in 1841. This may be significant as these Hebrew studies would have brought him into contact with astronomer Temple Chevalier. He was granted a Licentiate in Theology after passing his examinations, on 23 June 1841 (*DUC*; Durham Alumni Records).

Of Octavius Pickard-Cambridge's (1828-1917) sojourn in Durham we have a much more detailed picture. In a statement attached to some volumes of notes of Prof Jenkyns' Divinity lectures (now held in the manuscripts section of the Palace Green Section, Durham University Library) he writes:

> I was in residence in Univ. Coll. from January 1855 to July 1858 (almost four academic years) – This gave me the opportunity of attending Dr J's course of Lectures, and some parts of it twice. When this last was so, the notes of the second attendance are in pencil on the opposite sides of the pages . . . the "Notes" are, I believe strictly and fairly accurately a record of what Dr Jenkyns said . . . whenever possible the Notes actually made in the Lecture Room were copied out fully and carefully the same evening.

(Pickard-Cambridge Papers: Old University MS, L V 34)

Octavius felt he was not outstanding academically, and had to work conscientiously to pass his examinations. But humour crept in. Once amidst some notes on Church History a face is sketched – the lecturer perhaps? At the end of the final set of notes is scribbled: "Farewell Jenks RIP". He was granted his Licentiate in Theology on 15 June 1857, and having stayed on in Durham for a further year, had a BA conferred on him on 2 November 1858. Successive entries in Crockford's show an MA for 1859, although there is no record of this in the *University Calendar*.

Octavius Pickard-Cambridge was born to the name Pickard, but his father added the Cambridge name when he inherited property from the Cambridge branch of the family; however, while he was at Durham he sometimes signed his name O. P. Cambridge. Like William Galloway, he was slightly older than the normal undergraduate age, having previously spent two years in London training unsuccessfully for the bar. Nevertheless he seems to have had a fairly active social and sporting life.

> He made great friends at Durham, and entered fully into the life of the University; we find him acting as Steward at steeplechases, and President of the University College Choral Society – he had a fine voice of wide range and he gave the Boat Club a Challenge Cup. (Pickard-Cambridge, 1918, p. 7.)

He does not seem to have studied much science in Durham. There are no scientific lecture notes amongst the ten books of notes he presented to the University in 1915. He may have attended the occasional general lecture, but the conscientiousness that he devoted to his theological studies and his participation in rowing, steeplechasing and singing would suggest that little time was available for this. He seems to have been largely a self-taught naturalist. He was evidently a keen collector of insects since his childhood, and the occasional Durham record in his subsequent publications suggests that some collecting was done during his years at university.

There is ample evidence that Octavius had a real affection for Durham. Apparently he had a banner with "the cross and arms of University College, Durham" upon it, that used to be carried in church processions when he was appointed to a Dorset parish in later life. His son, when sending a copy of a "short memoir" about Octavius to the Durham University Library wrote that he was "a very loyal Durham man", and this would be confirmed by his (Octavius') decision to donate his notes to the University in 1915. He does not seem to have had a very strong association with Durham after his ordination, although he may have visited on his honeymoon in the spring of 1866, as in the course of the "wedding tour" he and his bride "visited nearly all the English cathedrals". He would surely have been unlikely, on such a trip to omit a cathedral as magnificent as that of Durham, and one that he knew so well.

Concerning William Henry Purchas (1822-1903) we have less information. Although several years older than Octavius Pickard-Cambridge, he was a close contemporary. He probably came into residence at University College in the Michaelmas Term of 1856, and left after the Easter term 1857; his Licentiate in Theology was conferred on 15 June 1857. he must have known Octavius well, among such a small group of students, and may have been in the group that "used to meet in the evening after each lecture and compare notes." We can be reasonably sure that he too retained an affection for the University, for on the publication of his book in 1889, he wrote to the University enclosing a copy: "as an old student of your college who has by no means ceased to feel an interest in the welfare of the University". (A letter from W. H. Purchas to the Rev Dr A. Plummer, dated December 1889, is bound into the copy of *The Flora of Herefordshire* in Durham University Library.)

Subsequent Clerical Careers

All three were ordained deacon within a few months of completing their courses at University College, and were priested a year later, each being about 30 years of age on ordination. They all took their first curacies in the North of England, subsequently moving

south. The Rev. W. B. Galloway was curate in Barnard Castle, Co. Durham, from 1841 to 1845; the Rev. W. H. Purchas was at Tickenhall, Derbyshire 1857-1859; the Rev. O. Pickard-Cambridge served his first curacy at Scarisbrick, Lancashire, 1858-1859 (where he had a hard time: the main land-owner was a Roman Catholic and would not allow a Church of England clergyman to live on the estate).

There the similarities ended.

William Galloway was curate at Holy Trinity, Bromley, 1845-1847, and then at St Pancras, 1847-1849. Thereafter he was Vicar of St Mark's, Regent's Park for nearly 40 years (1849-1888). He seems to have thrived on city life, and made numerous contacts in London: he was chaplain at various times to Viscount Hawarden and Earl de Montalt. He died on 20 March 1903. (Biographical information on W. B. Galloway is somewhat sparse; sources used include *University Calendars*, Alumni Records and issues of the *Durham University Journal* [DUJ].)

Octavius Pickard-Cambridge, however, for the most part shunned urban centres. After his time in Lancashire he became curate in his father's Dorset parish of Bloxworth (his father was effectively both squire and parson – 'squarson'). During the period 1860-1868 Octavius spent a total of two years travelling abroad, both on the continent (Italy, Germany, Austria, Switzerland, Corfu) and in the Near East (Egypt, Syria, and what was then known as Palestine). In terms of scientific contacts made, and specimens (spiders and insects) collected, these travels proved extremely useful. He later wrote of a period in Egypt, January-April 1864:

> [S]uffering a good deal from climatic influences I was unable to work very hard. But nevertheless he was able to collect: . . . several hundred species of insects of all orders, besides 164 species of spiders . . . as well as a few Acaridea and Scorpionidea. (Pickard-Cambridge 1876.)

Following the death of his father, Octavius succeeded him as Rector of Bloxworth, remaining in that position until his death 50 years later. This long association with a single parish enabled him to gain an extraordinarily detailed knowledge of the Dorset heaths. A point of comparison with William Galloway was his holding the position of chaplain to Sir Frederick Johnstone, High Sheriff of Dorset in 1889 and 1890 (Pickard-Cambridge 1918; Collons 1977).

Exactly what course William Purchas' clerical career took immediately after his curacy in Derbyshire is not clear. Later issues of *Crockford's Clerical Directory* show him in curacies in Gloucestershire (Lydney, 1865-1867; Tredford St James, 1867-1870), not very far from his birth-place at Ross-on-Wye, where, to judge from the records in the *Flora* he later prepared, he regularly botanised (e.g. *Festuca sylvatica*, noted as being found at Downton Gorge, on the right bank of the Teme, 1869). However, *Crockford's* is silent on the period between 1859-1865. *Cox's Clergy List* for 1862 simply gives his address as 'Calke, near Derby', but says nothing more. It may have been that he was in non-clerical employment for a few years – a private tutor perhaps. 1870 saw him instituted as Vicar of Alstonfield, Ashbourne, Staffordshire in the Diocese of Lichfield, an incumbency he held until his death, aged 81 on 16 December 1903. Apart from the local paper's comment that "he faithfully discharged his ministerial duties, living the life of a sincere Christian in Harmony with his high calling", we know relatively little about his ministry.

Scientific Work and Theological Views

Like many parson-naturalists, William Henry Purchas had a lifelong devotion to the field botany of his native county – in his case Herefordshire. Although he "removed from the county" as a relatively young man, he retained lifelong his affection for the county, its countryside and its plants. He was pleased to have a clerical colleague (the Rev. Augustus Ley, BA, Christ Church, Oxford, Vicar of Sellack with Kings Capel) who was resident in Herefordshire and was able to assist him in his studies. William Purchas had previously written one or two short pieces on the local flora for publications in the Ross-on-Wye area, but the completion of the *Flora of Herefordshire* (Jakeman and Carver, Hereford, 1889)

was essentially his life's work in natural history. It is a very thorough and scholarly work. Previous literature had been carefully surveyed for records, and very detailed information on the distribution of plant taxa is given. William Purchas had a special knowledge of the genera *Rubus* and *Salix*, both difficult taxa, and dealt with the many species and varieties in a masterly manner. The dates of some of the records show that William Purchas had been an enthusiastic field botanist since his teenage years; thus *Geranium pratense* had been found by him "about 1839".

In the first chapter the county is divided into 14 "botanical districts", with a brief description of each. To add to the usefulness of this chapter to naturalists of all types, William Purchas arranged for another clerical colleague, the Rev. W. E. Symonds, FGS, Rector of Pendock, to write notes on the geology of each district; these provide a straightforward review of the stratigraphy and palaeontology of each area, with brief comments on matters such as the way in which erosion had developed different landscapes from different lithologies. The chapter is thus an entirely conventional summary in terms of the state of geology in England some five decades after the publication of Charles Lyell's *Principles of Geology*; for example, there is an attempt at a correlation of the Old Red Sandstone rocks of Herefordshire with the Devonian and Old Red Sandstone of other parts of the British Isles. The association of particular fossils (e.g. the primitive fish *Cepalapis* and *Pteraspis*) with particular strata is mentioned, as are the effects on the landscape of the Woolhope Dome (a major upfold in the layered rocks of the region) of "the long ages of denudation".

Symonds had excavated some of the caves near Whitchurch over the period 1870-1872, and describes finding the bones of several extinct mammals in them (including the mammoth and bison). He goes on: "Prehistoric Man also must have sought them as a refuge, as his chipped flints and fractured pebbles were found associated with the bones of extinct mammalia". He is clearly a disciple of Lyell, and quite possibly Darwin, for he seems to accept the notion that humanity is extremely ancient, and also that the techniques of geology and palaeontology are appropriate to the study of its antiquity (W. E. Symonds, Notes on geology, in Purchas and Ley 1889).

It seems that in commissioning Mr Symonds to write the introductory geology section to his *Flora*, William Purchas got something a little different from what he expected, for in the front of the copy he presented to Durham University Library is a quite lengthy, hand-written statement:

> In reference to some of the following notes of the Geology of Herefordshire and certain conclusions advanced therein which seem incapable of reconciliation with the Mosaic account of the Creation I should wish to say that while it may be quite true that these conclusions may seem to be legitimate deductions now, or to be now demanded by the facts at present known to Geologists, it is equally true that in a science such as Geology which is still youthful, new and important facts may any day be brought to light which may demand considerable modification of views now widely and very positively maintained, and that while we do not at present see how the testimony of Genesis & that of the rocks are to be harmonised, we may best [be] satisfied that a fuller understanding of the matter will shew there to be substantial accord. I regret that this note was not printed at the end of the Preface.
>
> William Henry Purchas

This provides a striking insight to the way in which Purchas attempted to reconcile his scientific work and his theological views. Although we know relatively little about his theology, it was stated in a local newspaper at the time of his death that "he represented the evangelical type of churchman" (*DUJ*, 16, 13), i.e. he identified with that party of the church that placed great emphasis on value of the scripture, often insisting on the literal truth of every part of the Bible. Many evangelicals, some of whom have been called "scriptural geologists", saw, as an important part of the scientist's work, the reconciliation

or "harmonisation" of the biblical record and that of the rocks. Although botany was his forte, not geology, Purchas was sufficient of a scientist to appreciate the logic of much of what his colleague, W. E. Symonds said, yet he retained the deepest respect for biblical truth. His views appear to have been not so very different from those of Galloway, although he had a much firmer grasp of scientific matters, and he was less extreme.

Although he is nowhere explicit, in his concern for the detailed taxonomy of the plants, in his understanding of the diversity and complexity of the plant world, and his obvious appreciation of the beauty of nature, Purchas would appear to be something of a "natural theologian". He would seem to accept that each different species was independently created by God. He would thus perhaps have argued that a justification of the careful study of "the flowers of the field" was the insight it gave to the mind of the Creator.

Octavius Pickard-Cambridge, in his subsequent career as a naturalist, wrote extensively on a wide variety of natural history topics. In 1852, before he went up to Durham he contributed several short notes to the *Zoologist* on such varied topics as the "Skin of a large snake", the white willow-wren, and robber bees. A listing of all his published papers shows five on Mammalia, four on Reptilia, about 36 on ornithology, some 53 on Lepidoptera and about 15 in the field of "general entomology". He also wrote nine articles on "antiquarian and miscellaneous" subjects – the first before he had graduated from Durham – and a couple on meteorology, as well as three biographical articles. By far his most significant contribution was to arachnology. He wrote some 180 papers on spiders throughout his career, the first in 1857, the last in 1914 (Pickard-Cambridge 1918). Perhaps his most lasting work was the two-volume *Spiders of Dorset*, Part 1 of which was published in 1879, Part 2 in 1881. Despite the title, it did not restrict itself to the spiders of the single West Country county, but dealt with the arachnids of other parts of Britain: those not found in Dorset were included in an Appendix; this division was not universally welcomed and was not repeated. He was sent specimens from all over the world, and he published material on spiders from, amongst other remote locations, Kerguelen, the Seychelles, Japan, St Helena, New Zealand, Siberia, South Africa, India, Paraguay and Newfoundland. Interestingly, he was amongst the first to comment at length on the behaviour of spiders and other invertebrates: in this as in much else he was ahead of his time. He was at one stage lent a fine binocular microscope by the Royal Society, and he had a quite extraordinary eye for detail, recording with exemplary exactitude the minutiae of the morphology and taxonomy of tiny creatures. An example is his *Monograph of British Phalangidea or harvest-men*, published in 1890. According to his son "His draughtsmanship was extremely accurate and at the same time artistic". He named many spiders that were new to science, always insisting on retaining a "type specimen" of a species he named. It was largely for his work on spiders that he was elected to a Fellowship of the Royal Society in the summer of 1887, signing the Roll on 24 November 1887.

Of Octavius Pickard-Cambridge's theological and philosophical views and churchmanship we know a good deal more than those of William Purchas. Whereas much of his scientific work, from his twenties onwards, was extremely innovative and original, in theological (and incidentally, political) matters he was deeply traditional. His son recorded: "He was an old-fashioned High Churchman, and took a somewhat severe view of Dissent", although it was noted that "no Dissenter ever found him lacking in charity in times of need". He emphasised the sacraments, greatly increasing the frequency of Holy Communion at his church in Bloxworth, and the Great Festivals. His son's account continues: "[H]is conduct of Divine Service was most reverent and dignified, and his reading of the Bible (a matter in which many clergy are sadly incompetent) was . . . impressive". His wife Rose, née Wallace, whom he married in Oxford in April 1866, was extremely devout, and also came from a noted High Church family.

Yet in some matters he had a striking independence of mind: on several matters of ecclesiastical administration (to name two examples, the management of church property and clergy pensions) he was quite outspoken at clergy gatherings. His views on evolutionary matters were most progressive, and indeed early in his career caused a bit of

friction. *On the origin of species* appeared around the time of his curacy in Lancashire.

> He was not wholly in sympathy with the attitude of most of the local clergy towards the vexed questions of the day, and he used afterwards to refer with amusement to their denunciation of the views of Darwin, then just published. With these views he was (apart from certain details) in entire sympathy, but his attempts to defend them at meetings of those who denounced without reading them were not well received. (Pickard-Cambridge 1918, p. 8.)

It is clear that Darwin's approach was of considerable value to him in his very detailed work on taxonomy, for example of the species of the spider genus *Erigone*. He was convinced that "new species were still, in all probability, in the process of formation", and that there existed "very long series of species or supposed species which are connected to one another by grades of variation so minute that no line can be drawn between them".

His son records:

> It has been mentioned already that he was an early Darwinian, and a number of rough notes and tentative essays, in which he tried to clear up his mind on various topics, show his special interest in the theory of evolution. More definite than these is his opinion on the problem of secondary sexual characters, upon which he corresponded a good deal with Darwin, Wallace, and others, – an opinion different from that of Darwin and more like that of Wallace, who quotes it (*Darwinism*, p. 296) in support of his own view. My father wrote (in 1869): 'I myself doubt that particular application of the Darwinian theory which attributes male peculiarities of form, structure, colour, and ornament to female appetency or predilection. There is, it seems to me, undoubtedly something in the male organization of a special and sexual nature, which of its own vital force develops the remarkable male peculiarities so commonly seen, and of no imaginable use to that sex. In as far as these peculiarities show a great vital power, they point out to us the finest and strongest of the sex, and show us which of them would most certainly appropriate to themselves the best and greatest number of females, and leave behind the strongest and greatest number of progeny'. (Pickard-Cambridge 1918, pp. 57-58.)

This is quite striking, for it anticipates Darwin's ideas on sexual selection, expressed in *The descent of man* (especially Chapter 8), published in 1871. Indeed it was in 1874, around the time that the second edition was being prepared, that Darwin corresponded with Pickard-Cambridge on the subject of the small size of the male as compared to female spiders, and the significance of other sexual differences. Pickard-Cambridge regarded many of these as a special case of natural selection, rather than evidence for a separate process of sexual selection.

> [T]here would be no reason to resort to "sexual selection" to account for male sexual peculiarities of structure whether of the nature of what we usually term "ornamental" or not. Of course what I have said presupposes an unexplained and perhaps unaccountable element in the sexual nature of the male, more powerful than that of the female.
>
> (Letter: O. Pickard-Cambridge to C. R. Darwin, Bloxworth Rectory, 17 Feb 1874. Cambridge University Library Darwin Archives: DAR 161. 1/7.)

Pickard-Cambridge was much honoured that Darwin corresponded with him.

His son concludes the discussion of Octavius' evolutionary views with the remark:

> It need hardly be added that my father saw no inconsistency between the theory of evolution, on the lines laid down by Darwin and Wallace, and the belief in the peculiar spiritual nature of man. (Pickard-Cambridge, 1918, p. 59.)

Theologically and philosophically William Brown Galloway seems to have been close

to W. H. Purchas. Vigorous evangelical that he was, he seems to have been something of a fundamentalist, and as one person put it after his death: "His great aim in life was the defence of Scripture" (Durham Alumni Records). This defence began in 1842, not many months after his leaving Durham, and continued until close to the time of his death, and constituted a stream of books and pamphlets aimed at demonstrating to literal truth of Scripture. His early writings were predominantly theological in tone, for example: *The chain of ages traced in its prominent links, by holy scripture from the creation of Adam to the close of the first century of the Christian Era*. These clearly demonstrate a conservative, literalist approach, and a concern for the Bible as a source of historical information. This concern for time runs through much that Galloway wrote.

Later he attempted, with more and more vigour, to show how the biblical record could be linked to the evidence of science in every respect. In particular he was at pains to demonstrate "scientifically" that the Flood described in Genesis had occurred: he was a "diluvialist". He published *Physical facts and the scriptural record* in 1872, *Science and geology in relation to the universal deluge* (1888) and *Testimony of science to the deluge* (no date, about 1895). In chapter 1 of the last of these he takes William Buckland to task for deserting the diluvian and catastrophist cause he had originally championed:

> It was only from about the year 1838 that the Glacial Theory began to be accepted by geologists in England, in opposition to the previous philosophical views of the ever-illustrious Cuvier . . . Even Buckland, the author of *Reliquiae Diluvianae* and of the Bridgewater Treatise on Geology, professed himself a convert to the theoretical conclusions of Agassiz in the year 1840. But his own sounder judgment is to be found in his earlier works. (Galloway, n.d. p. 15.)

He goes on to castigate "some clergymen of more or less distinguished position" who defer to "certain popular men of science putting forward as unquestionable their magnificent though unproved speculations".

His own speculations were fairly florid. A single example must suffice. The Cretaceous chalk, with its nodules of flints that underlies much of East Anglia, parts of Lincolnshire, and east Yorkshire, was, he felt, meteoritic in origin, having formed on dry land.

> I am prepared to show many objects of the dry land in flint, which could not have been formed under water . . . These consist of portions of decayed tree roots in flint, with the bark in places where the wood had fallen away . . . [P]ortions also of other and larger trees from the chalk district of Yorkshire . . . hollow stalks of cabbage . . . also pods of beans . . . all of flint . . . gourds or other vegetable fruits . . . roots of turnip and specimens of fungus, all of flint.
>
> . . . [C]onsidering the vast extent of the chalk and flint formation, it is manifest that had it all fallen upon the earth at one time, it might have materially affected the earth's balance. But, coming by degrees at successive periods, the balance might adjust itself by the flow of waters of the sea to the opposite side of the globe where the weight had to be counterbalanced . . . [T]he gradual accumulation of a vast mass of compensating waters on the opposite side of the world, might, by its superincumbent weight, . . . break down the underlying strata there. (Galloway, 1888, p. 3.)

These movements altered the equilibrium of the earth: "a change of axis would demonstrably result . . . [and] such a change of axis would produce a universal deluge". (Galloway, 1888, p. 41.)

Although there was not much evidence of fieldwork, beyond perhaps occasional brief descriptions of rocks or landscapes and some photographs of curiously-shaped flints, all this was backed-up by numerous quotations from scripture and other ancient writings.

William Galloway produced many books and pamphlets of similar character, some of them going into several editions, and the last written when he was over ninety: he seems to

have been a determined and something of a stubborn man. Often his speculations were supported by pages of mathematics, quotations from Greek authors (in the original) and careful selections from contemporary geological and other scientific authors. The method is somewhat reminiscent of some late twentieth century "creation science" writers (also often rather extreme evangelicals): tiny snippets from worthy authorities are quoted quite out of context. Nevertheless, despite the wry amusement with which such ideas are received in scientific circles today, Galloway was typical of many scriptural geologists, although few of them were quite as prolific as he.

Envoi

Alike in their education at University College, Durham, between 1839 and 1858 the three clergymen described here exemplify between them many aspects of the parson-naturalist tradition. Their lives virtually spanned the nineteenth century, the hey-day of the genre. One was a botanist, one a zoologist, one (if one is broad-minded) was "something of a geologist", and thus they exemplify the range of natural history interests of the clergy. One, like so many other clergy-botanists, edited his county flora; another devoted the greater part of his life to study of the natural history of a single small area, and to a considerable extent, to the working out of a single biological group. All were conservatives in their own way: one a high churchman, two others on the evangelical wing of the church.

Where they differed was the manner in which they reacted to the challenges of nineteenth century science in relation to their faith, for example in the extent to which they took the new ideas of gradualism or uniformitarianism in geology, and the innovative notion that much of Britain (and indeed the northern hemisphere land masses) had been affected by glaciation, and of course the theory of evolution.

William Galloway rejected these ideas, as far as one can see, in their entirety. Scathing of the glacial theory, he resolutely continued to believe that the earth was but a few thousand years old, and that every incident in the earth's history could be confirmed with reference to the Bible. Although a prolific writer, he could not, in all honesty, be called a scientist.

William Purchas was perhaps slightly less extreme. He distrusted geology rather less, feeling that as more became known of the record of the rocks a greater degree of reconciliation with the Old Testament might be possible. Plants were living things of great interest and beauty, evidence perhaps of the ingenuity of the Creator, and worthy of study for their own sake. He made no use of evolutionary ideas in interpreting their taxonomy; and although there is no record of his views on Darwin's theories, it can be assumed that he would not have approved of them. He produced but one major work of natural history.

Octavius Pickard-Cambridge was by far and away the most distinguished scientist of the three. Fellow of the Royal Society, and Honorary Member or Fellow of a host of other scientific bodies he was also by far the most productive, writing several books, and hundreds of scientific papers. He had a international reputation. Despite his respect for the teaching of his Church and the Bible, he was much more open to modern ideas. Being of the High Church party, rather than of the evangelical wing, he did not adopt a quite such a literalist approach. He thought long and hard about Darwin's evolutionary views, and discussed them widely, finding in them an important key to the understanding of the taxonomy of certain groups of his beloved spiders.

All three individuals discussed here illustrate aspects of the intellectual life of the nineteenth century church. While it is interesting to note how often it was that parson-naturalists were in the forefront of their field (like Octavius Pickard-Cambridge), it should be noted that others were content with a purely local reputation (like William Purchas), and it does not do to get too "whiggish: it is occasionally instructive to explore blind alleys and culs-de-sac, and to examine the ideas and personalities of the odd, the misled, the now-forgotten and obscure (like William Galloway).

There are a couple of other general points that may be made. Churchmen have contributed much more than theology over a long period, but it was the nineteenth century

that was the hey-day of the parson-naturalist. This was the time when the structures of disciplines were forming. University departments were founded, chairs were endowed, societies were established, major theories were being propounded. Some clergymen-scientists – Henslow, Sedgwick and Bonney among them – entered the academic hurly-burly with gusto. Some, like Pickard-Cambridge, dallied at the edges, vigorously supporting their local societies, only occasionally venturing (in Octavius' case) further afield. Others largely ignored (and were ignored by) the academic mainstream. Yet the sum of the achievements of those working in a church, rather than a university framework, and thus to some extent able to stand aside from an agenda imposed by professional science was enormous.

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BOOK REVIEWS

Fly Fishing: The North Country Tradition by **Leslie Magee.** 1994. Pp. 218, with 15 colour plates, 16 black and white photographs and 3 maps. Smith Settle Press, Otley, £22.00.

The North Country traditional method of fly fishing for brown trout involves the use of sparsely dressed, soft-hackled artificial flies fished upstream. Such flies, tied with feathers from readily available game birds such as partridge, snipe and grouse, have been used for years on the rivers of the northern counties to the Scottish borders, in contrast to the artificial flies dressed with poultry feathers that were more commonly used in other regions of Britain. The patterns with a characteristic combination of coloured silk and specific feather, sometimes with a hint of head and thorax and a film of hare or mole fur, were tied to represent recognisable insects on the water during fixed weeks or even days during the spring and summer months. They were designed by skilled anglers with an intimate knowledge of the insects on their own river and simulations capable of deceiving a trout. A simple classification of the insects evolved but the given binomials such as Waterhen Bloa, Dark Watchett and Spanish Needle had a North Country rather than Latin origin and were more descriptive and evocative. These fly fishing innovators supplemented their meagre income as farmers, millers, water bailiffs or cobblers by selling their special creations, the fish they caught and by tutoring other anglers and visitors, but their patterns usually remained closely guarded secrets, passed on within families by word of mouth or recorded in manuscripts.

In the late nineteenth and early twentieth centuries, a few noted, literate anglers such as Pritt, Walbran, Edmonds and Lee compiled books, published in very limited editions, describing North Country fly fishing methods and providing details of the fly patterns they had gleaned from their originators, although they very rarely acknowledged the sources of their information.

Leslie Magee has assiduously traced the origins of North Country methods of fly fishing and the necessary fly patterns from the innovators to the publicists, giving fascinating biographies leavened with anecdotes which illuminate our understanding of those early days of angling. He has consulted old manuscripts and notebooks, traced kin through parish records and pieced together a jigsaw of snippets and facts to present a veritable mine of information. He goes on to relate fly patterns to insect species and maps the distribution of these species in northern rivers and man-made waters such as canals and reservoirs. This scholarly work is well illustrated and has been beautifully produced. It has been eagerly awaited by anglers all over the world as the sparsely-dressed, soft-hackled spiders, originally designed say for the Wharfe or Ure, have proved successful in waters from Scandinavia to the Antipodes.

TC

The Common Ground of Wild and Cultivated Plants edited by **A. Roy Perry** and **R. Gwynn Ellis**. Pp. x + 166, 14 colour photographs, 25 b/w photographs, 4 line drawings, 12 maps, 8 tables and a key. 1994. National Museum of Wales. £24.95 paperback.

This volume is the report of a conference of the Botanical Society of the British Isles held at the National Museum of Wales, Cardiff, in July 1992 to coincide with the Garden Festival at Ebbw Vale.

The cover, depicting a somewhat out-of-focus hybrid *Mimulus* apparently severely afflicted with oral thrush, belies the content which is very much in focus with regard to the common ground of wild and cultivated plants.

Eighteen of the twenty half-hour papers given at the conference are included and range widely over the subject matter. The first writer philosophises on man's relationship and responsibilities to other biota and ecosystems. Others deal with plant introductions, ergasiophygophytes (garden escapes to you and me!), alien forms of British plants, our debt to Victorian fern collectors, teratogeny (aberrant forms), the spread of alien plants in wild situations, conservation and propagation. Several writers deal with taxonomic confusion and problems of particular genera.

Most of the writers put their case clearly and interestingly and the papers are variously instructive, thought-provoking or entertaining. There are a few typographic errors. The colour photographs illustrating two of the papers are excellent, the black and white ones slightly less so. The price is rather on the high side for a slim paperback but the book is enjoyable reading.

PPA

Wild Otters. Predation and Population by **Hans Kruuk** Pp. viii + 290, with 64 monochrome photographs and numerous line drawings, maps and diagrams. 1995. Oxford University Press. £30

In this comprehensive review of the ecology of the otter the reader has the benefit of the author's four years of field observation from 1983 to 1987 at Lunna Ness on the east coast of mainland Shetland; here, otters were common, exploiting the marine environment. Pleasingly, there is a broader coverage with frequent reference to the fresh-water habitats of the Rivers Don and Dee and their tributaries in north-east Scotland.

There are seven main chapters, each helpfully preceded by a synopsis. The topics covered include spatial organisation, social behaviour, diet, fish as prey, otter fishing, thermo-insulation and populations.

Apart from the intrinsic value of the material this book contains, it is also an object lesson on how a vast quantity of data can be obtained from the simple expedient of direct observation on a secretive and elusive animal. This is invariably followed by the precise presentation and summary of the data. For example, in the chapter on diet, the reader is told the species of fish caught, their numbers, weight, size, variations in take with season and location and food choices of adults with and without cubs. Throughout the book there is an abundance of diagrams, graphs and histograms to amplify and reinforce the material in the text.

The final chapter deals with man and conservation and highlights some of the main threats (habitat change, pollution and persecution) not only to the European otter but to all species world-wide. Making use of the information obtained earlier, the author carefully argues the case for and outlines the conditions necessary for improving the present status of the otter. As an animal near the end of the food chain, Hans Kruuk regards it as essential that the otter's future be secured in the context of a broad habitat management. It is pleasing to see the inclusion of this chapter as the culmination to the intensive and dedicated field work.

This book, written by one of our leading authorities on carnivore biology, provides a clear, readable account of the natural history of one of our most interesting wild mammals. In so doing it will deservedly appeal to a wide audience.

MJD

YORKSHIRE NATURALISTS' UNION EXCURSIONS IN 1993

Edited by C. S. V. YEATES
Tolson Memorial Museum, Huddersfield HD5 8DJ

SKIPWITH COMMON (VC61) 17th July (J. Payne)
In this poor summer we were lucky to have a reasonable day. About 40 people attended the excursion and dispersed over different areas of the common. Tea was taken in Kelfield Village Hall. The President, Professor Geoffrey Fryer, took the chair at the meeting which followed. Twenty-seven people were present, among them four past presidents, one of whom, Dr Michael Thompson, was a former chairman of the Skipwith Common Management Committee. It was a great thrill to see two lizards basking – in the brief sunny spell – on the newly erected wheel-chair ramp. These constituted the first sighting for eight years. Common Frog, Common Toad and Smooth Newt were all reported; otherwise vertebrates were little in evidence.

At the end of the reports Mr K.G. Payne proposed a vote of thanks to the landowners, the Forbes-Adam family, and to the Yorkshire Wildlife Trust. Full reports have been passed on to the new Lowland Heaths Officer at the YWT Head office.

ORNITHOLOGY (M. L. Denton)
It was pleasing to be able to record the presence of Willow Tit, Redpoll and Yellowhammer. All three species have suffered national decline but were present in good numbers. Family parties of both Green and Great Spotted Woodpeckers were seen and both species may have bred on the reserve. As most bird species have ceased to sing by this time of year it is hardly surprising that the only warblers encountered were Chiffchaff, Willow Warbler and a single Whitethroat. A Green Sandpiper was heard as it flew over the reserve. Thirty-eight species were located during the course of the day.

LEPIDOPTERA (J. Payne)
Most of the recording was undertaken by Mr H. E. Beaumont and Gavin Boyd who have submitted a list of 62 species. Gatekeeper and Ringlet were the most notable of the nine butterflies seen. Among the 21 macro-moths seen, Lunar Hornet Moth and Six-belted Clearwing – both members of the Sesioidae – were excellent new records for the Common. The Pinion-streaked Snout, taken by Mr Boyd, verified its continued occurrence in its old haunt. Common Footman, Pebble Hook-tip and Coxcomb Prominent were among those seen as imagines, and The Miller was seen as a larva. Thirty-two 'micros' accounted for the rest of the list.

FRESHWATER CRUSTACEA (G. Fryer)
The acidic nature of Skipwith Common is not conducive to the development of a diverse freshwater crustacean fauna. Previous visits have revealed only eight species – though some of these are sometimes exceedingly abundant. As the south-west corner had not been explored previously, attention was devoted to this area. Five of the species known to occur at Skipwith were found, as was the harpacticoid copepod *Bryocamptus pygmaeus* which was located in wet *Sphagnum*. This very common species has been found on other lowland heaths in Yorkshire. *Daphnia obtusa*, the only acid-tolerant *Daphnia*, was plentiful in a large pond and in interconnected pools representing the marshy remnants of another, as was *Scapholiberis mucronata* (which was present in vast numbers in the pools). The only other anomopod – found in several places – was the very common *Chydorus sphaericus*. The cyclopoid copepods *Acanthocyclops vernalis* and *A. languidus* favour habitats provided on lowland heaths. Both have been found on all six such heaths explored in Yorkshire.

FLOWERING PLANTS AND FERNS (D. R. Grant)
The reserve is situated on glacial soils and there is a mixture of both sandy and clay areas

together with overlying peat formations. On the Common there are both dry and wet areas with a number of open peaty pools. On entering the woodland at the west end of the reserve members were impressed by the spectacular flowering of the pink-petalled bramble *Rubus sprengelii*. This is a low, creeping species confined to oak/birch woodlands on acid soils; it is rare in this vice-county. Other species here on the edge of the wood were *R. lindleianus*, *R. plicatus* and the commonest British species *R. dasyphyllus* (although again the latter is infrequent in VC61).

On the old runways there was much *Sedum album* and the introduced *Acaena anserinifolia*, while along the edges were *R polyanthemus*, *R. eboracensis* and *R. pruinosus*. Open areas held *Centaurium erythraea* and *Aira praecox*. *Pilularia globulifera* was seen at its station, but not in quantity as in previous years. Here there was much *Juncus bulbosus* together with *J. acutiflorus* and *Carex disticha*. The pool had a small stand of *Scirpus lacustris*.

Members then moved on to the centre of the reserve. In one open space, where the ground is damp, were *Drosera rotundifolia*, *Anagallis tenella*, *Salix repens* and *Agrostis canina*. The nearby ride edge had *Frangula alnus*, *Rubus caesius* and *Calamagrostis epigejos*.

The party then returned to the meeting place by way of the main access road. In a ditch alongside this were *Scrophularia auriculata* and *Scutellaria galericulata*. In damp grass alongside the edges of the road were several orchids: there were few specimens of *Listera ovata* and *Epipactis helleborine*, but a number of stands of *Dactylorhiza fuchsii*.

My thanks are due to Mr A. Newton for identifying some of the uncommon *Rubus* species.

BRYOLOGY (T. L. Blockeel)

Much of the day was spent on an examination of some of the bog pools, particularly in the Sandy Lane area of the common. However, only a limited bryophyte flora was found to be present, dominated by *Sphagnum cuspidatum* and, locally, by *Drepanocladus fluitans*. The effects of drying out were evident, and many areas of damp heath had become overgrown. There were small quantities of *Leucobryum glaucum*, *Aulacomnium palustre* and *Polytrichum longisetum* on open ground, but almost no bog hepatics. *Campylopus introflexus* was locally plentiful on dry peat, and there were some good patches of *Ptilidium ciliare* in an old pine plantation.

The more mature areas of woodland proved to be richer than the heath. *Cephalozia connivens* was found on rotten wood, and *Sphagnum palustre* and *S. fimbriatum* were fairly plentiful in some of the wetter areas. Drier woodland near the Visitors' Centre had some very fine *Plagiomnium affine* on its floor, and *Plagiothecium denticulatum* on a tree bole. A small quantity of the strict epiphyte *Orthotrichum pulchellum* on the old branch of a sallow was one of the best finds of the day.

A number of species were noted only on the old runways. These included *Tortula ruralis* and *Brachythecium albicans*.

In all 40 mosses and 7 hepatics were recorded.

MYCOLOGY (M. Sykes)

Several agarics, most of them common ones but including *Russula velenovskyi*, were observed. *Fomes fomentarius* – a feature of the common – was common on *Betula*, and *Daldinia concentrica* (most often associated with *Fraxinus*) was very common on dead and dying wood of *Betula* by the path sides.

PLANT GALLS (L. Lloyd-Evans)

A total of 18 galls was recorded. Very conspicuous beside the dykes were distorted leaves of *Polygonum amphibium*, caused by the gall-midge *Wachtliella persicariae*; the leaf margin was inrolled, thickened and varied in colour from yellow through orange to pink and purple. Another colourful find was a crimson pea-sized gall decorated with white

raised lines and attached to the underside of an oak leaf. This was the work of the gall-wasp *Cynips longiventris*, which is rather local in Britain.

The gall-midge *Dasineura plicatrix* attacks the mid-ribs of young bramble leaflets, twisting them into pleated folds; cecidologists are usually content to record the host as *Rubus fruticosus* agg., but luckily Donald Grant was available to identify the host as *R. pyramidalis*, a Skipwith speciality.

HUTTON COMMON AND SPAUNTON MOOR (VC62) 14th August

Thirty-five members representing 22 affiliated societies assembled on Hutton Common on a fine August morning and were introduced to two contrasting areas. The meeting was held with the kind permission of the owners, Spaunton Estates.

Hutton Common is situated on the Jurassic limestone. The area contains several disused quarries and we had limited access to the River Dove, which flows through Dowthwaite Dale. Most members dispersed into this area during the morning. Several tracks were obstructed by bracken which had thrived during the wet summer.

Lunch was taken at the meeting place, following which most members visited Spaunton Moor, north of Hutton-le-Hole and Lastingham villages. This is predominantly acidic moorland, with a number of becks flowing southwards of the Moor. One or two flushes showed evidence of alkalinity. A viper was seen at Hole Beck and several colonies of mining-bees were observed on bare ground. The tea and meeting were held in Fadmoor village hall, with 31 members present to hear the reports.

ORNITHOLOGY (J. M. Blackburn)

Birds seen during the day included Grey Heron, Green Woodpecker, Kingfisher and Marsh Tit. Many House Martins were observed on the edge of the Moor.

LEPIDOPTERA (J. Payne)

I have visited Hutton Common for 40 years and know that it is a rich area for butterflies and moths. 1993 was proving to be a poor year, and so I was pleasantly surprised to find that 13 species of butterfly and 6 macro-moths had been observed. Unfortunately, many were single sightings, larvae being particularly scarce.

Species recorded were Small Skipper, Large, Small and Green-veined Whites, Common Blue, Red Admiral, Small Tortoiseshell and the rarer Comma. Gatekeeper was the rarest 'brown', but Meadow Brown, Small Heath and Ringlet were also present.

The tiny Small Purple-barred taken by Mr G. Boyd was the best find of the day. As it is said to feed only on *Polygala* and *Pedicularis* species it is a moth with a restricted distribution. Other moths were Silver Y, Beautiful Golden Y, Smoky Wainscot, Shaded Broad-bar and Yellow Shell.

COLEOPTERA (R. B. Angus)

Collecting Coleoptera so late in the season, despite the good weather on the day, did not turn up a great deal of material. However, there were some exceptions. The rove beetle *Atheta gagatina* was found in fungal material; this is a new vice-county record, although it is a widespread insect. Other Aleocharines encountered were *A. crassicornis*, *A. castanoptera*, *A. nigripes* and *Autalia impressa*.

Very large numbers of a *Sphaeridium* species were found in cow dung in the fields. This proved to be *S. lunatum*. Until recently this genus was considered to have three species, but recent work has shown there to be a fourth.

The find of the day was undoubtedly a rove beetle belonging to the genus *Octhephilus*; this still remains to be identified to species level. There are four species within the genus, all of which are rare.

FRESHWATER BIOLOGY (L. Magee)

The morning was spent in Douthwaite Dale, on a short length of the River Dove where the

water flows over stable limestone outcrop, although the bed is unstable in places. Substantial amounts of silt are deposited in the river during spates, especially near the banks. The high pH value (8.5) of the water and the silt provided ideal conditions for a large population of the burrowing larvae of the large mayfly *Ephemera danica*. First year nymphs were found mainly in the centre of the stream, and second year nymphs were close to the banks. The aquatic moss *Fontinallis antipyretica* was common and it sheltered larvae of the stonefly *Amphinemoura sulcicoliis* and of the mayfly *Ecdyonurus torrentis*. The freshwater shrimp *Gammarus pulex* was plentiful in the deeper pools. The most common caddis larvae were those of the non-casemaking *Rhyacophila dorsalis*.

Surprisingly, for a river noted for two hundred years as a trout stream, no trout or fry were seen, although there was a large population of the bullhead *Cotus gobio* (including some unusually large specimens).

During the afternoon a survey was made of part of Hutton Beck just north of the village. By contrast with the Dove, this acid moorland stream had a pH of 4.9. The discovery of several larvae of the mayfly *Amelitus inopinatus* was considered to be notable here. This species has a very local distribution in upland streams in Yorkshire.

An unexpected find was a single well-grown larva of the golden-ringed dragonfly *Cordulegaster boltonii*, which has been previously reported from North Yorkshire, although there are no recent sightings. After confirmation of its identification, the larva was later returned to the same stream.

Flowering plants and ferns (D. R. Grant)

In the morning members explored Hutton Common, which is situated on Jurassic limestone and contains the remnants of several old quarries. The most noteworthy plant here is *Cirsium eriophorum*, and there were many fine specimens in full flower on the top part of the common. There was also a large quantity of *Mentha suaveolens* by the car parking area.

The open grassland held typical calcicoles, the most interesting being *Helianthemum nummularium*, *Scabiosa columbaria* and *Catapodium rigidum*. Along the track sides were many plants of *Inula conyza*, growing with *Origanum vulgare*, *Rubus eboracensis*, *R. caesius* and *R. vestitus*. In one old quarry there was a stand of *Atropa belladonna*, and nearby on open grassy areas were *Silaum silaus* and *Gentianella amarella*. The effect of leaching was noticeable in a few places, with acid lovers such as *Ulex europaeus*, *Teucrium scorodonia* and *Rubus dasyphyllus* in evidence. At the north-western corner of the common there were a few plants of *R. warrenii* and *R. nemoralis*.

In the wooded part near the River Dove *Rubus pallidus*, *Primula vulgaris*, *Carex pendula* and *Melica uniflora* were present.

In various sites around the village members reported *Legousia hybrida* as an arable weed, and *Hypericum humifusum* was seen on a dry roadside bank.

The afternoon was spent examining the moorland streams and bogs to the north of Hutton-le-Hole. In a known locality on Spaunton Moor, *Hypericum elodes* and *Pinguicula vulgaris* were seen. *Sagina nodosa* was discovered on an area of track-side, and a stretch of track leading on to the moor near Chamomile Farm had *Aira praecox* and *A. caryophyllea*, the former being very abundant, forming pure stands on bare ground between clumps of *Calluna*.

Many of the bogs had *Drosera rotundifolia*, *Juncus acutiflorus*, *Carex echinata* and much *Myrica gale*. From one area of marsh north of Hutton *Narthecium ossifragum* was reported.

On Tranmire there were flushes which showed signs of some alkalinity. Here were *Anagallis tenella*, *Hydrocotyle vulgaris* and *Parnassia palustris*. The very wet areas held many sedges, including *Carex hostiana*, *C. viridula* and *C. dioica*, together with small quantities of *Scirpus setaceus* and *Eleocharis quinqueflora*.

Bryology (J. M. Blackburn)

The morning was spent on Hutton Common. The quarry around the car parking area

produced four *Barbula* species, including *B. hornschuchiana*. Grassy banks contained *Hylocomium splendens*, *Rhytiadelphus triquetrus* and *Climacium dendroides*. Interesting finds on the outcropping limestone on the ridge were *Dicranum bonjeanii*, *Ditrichum flexicaule*, *Encalypta streptocarpa*, *Homalothecium lutescens*, cushions of *Tortella tortuosa* and, in shade, *Neckera complanata* and the liverwort *Porella platyphylla*.

Acid woodland in the northern part of the area produced several liverworts, including *Barbilophozia attenuata* and *Calypogeia muellerana*. Also here, and in leached areas in the south, were *Dicranum scoparium* and two *Campylopus* species. Several common epiphytes were also found. Rocks in the River Dove had *Fontinalis antipyretica*, *Dichodontium pellucidum* and *Scapania undulata*. The total number of species recorded in the morning was 65, including 13 hepatics.

In the afternoon, a rushed visit to Spaunton Moor produced 42 species, only five of these being hepatics. Marshy areas contained seven common species of *Sphagnum*, *Aulacomnium palustre* and *Philonotis fontana*. The banks of Hole and Tranmire Becks had *Pogonatum aloides*, and *Racomitrium aciculare* was growing on rocks in Tranmire Beck. The drier moorland had several pads of *Leucobryum glaucum*, and there was evidence of alkalinity in one flush which held *Ctenidium molluscum*.

Mycology (C. R. Stephenson)

This was not a very fruitful day for fungi, for although there had been several wet days prior to the meeting, temperatures on the whole had been low. Humidity had also been low, strong winds not having helped the situation.

The first area visited was a Corallian Limestone escarpment with a number of old quarries. Several fruit-bodies of *Agaricus vaporarius* were growing in a roadside verge. This is a robust species with a large fleshy ring and a cap breaking up into large scales. Whilst this is an edible species, it is wise to avoid specimens growing by roads, as fungi are effective concentrators of heavy metals, including lead.

Several species of *Leptonia* were fruiting in short grass on the floor of one of the old quarries. One which was shown me was *L. incana*, an unusual agaric inasmuch as it possesses a green stem, a colour rare among the fungi.

The find of the day was *Drosella fraccida*, found by Mr Sykes. This is an uncommon species, with free white gills producing a cream spore print.

I mistakenly accompanied a group of coleopterists. If you are not in the vanguard of such a group all you find of any specimens which have passed their sell-by date is scattered ruins, the remnants of the groups search for beetles.

From the escarpment we moved downhill towards the River Dove, passing through an area of *Betula* and *Pteridium*. Several species were found which are typical of such areas: these included *Leccinum versipelle*, *Boletus badius*, *Amanita rubescens* and *Laccaria laccata*. On an old oak stump by the side of the river was a fine group of the "maze-gill" bracket fungus *Daedalea quercina*.

After lunch, a contrasting acid moorland area was visited. This was Fairy Call Beck on Spaunton Moor. A small copse of *Quercus* and *Larix* alongside the beck was searched, but very little was found. On a bank above the beck *Suillus luteus* and *Lactarius rufus* were present, suggesting that a specimen of *Pinus* had once grown there. A small group of the delightful *Hygrocybe cantharellus* was growing in a wet grassy area on the moor.

Stocksmoor Common and Stoneycliffe Wood (VC63) 22nd May (R. B. Angus)

Coleoptera (R. B. Angus)

Despite the good weather on the day and a reasonable turnout of coleopterists, surprisingly little of interest was found at either site; the exceptions were as follows.

On Stocksmoor Common, very close to the meeting place, a small pile of decaying grass was found to contain the Aleocharine *Atheta cadaverina* in its sixth locality for the county. All previous sightings have been in VC63. On the reserve itself a single specimen of the weevil *Dorytomus tortrix* was found on *Populus tremula*.

In Stoneycliffe Wood the soldier beetle *Podabrus alpinus* was found. A further visit two days later turned up a specimen of the carabid *Pterostichus oblogopunctatus* and a single *Hylecoetus dermestoides*.

Flowering plants and ferns (D. R. Grant)
Stoneycliffe Wood is a mixed woodland with some planted trees, including *Acer pseudoplatanus* and *Castanea sativa*. Within the wood there are colonies of *Lamiastrum galeobdolon* and *Milium effusum*. There is a stand of *Calluna* and *Vaccinium myrtillus* in one open area; these two plants are rather rare on Coal Measures soils. In bogs near the Coxley Valley beck is *Cardamine amara* and much *Oenanthe crocata*, and in one spot there is a colony of the rare *Scirpus sylvaticus*. This wood has one of the Pennine brambles, *Rubus sprengelii*, recorded here a century ago by F. A. Lees and mentioned by P. F. Lee in his *Flora of Dewsbury*. Here and there are a few colonies of *Ceratocapnos* (*Corydalis*) *claviculata*. In the valley there, a marshy area to the west of the reserve has a stand of *Populus tremula*.

On the south-facing valley side of the Coxley beck the hedgerows have *Rubus lindleianus*, whilst in one rough grassy field is an area where *Genista tinctoria* and *Ononis repens* grow.

Stocksmoor Common abuts Stoneycliffe Wood, and is situated on the highest ground of the district. It is a typical Coal Measures common, again supporting an acidophilous flora. *Betula* and *Quercus petraea* are abundant, with *Salix* species in the damper areas. Open ground is dominated by *Deschampsia flexuosa* and *Nardus stricta*, with some stands of *Carex nigra*.

In some places *Pteridium* forms dense stands. Brambles are represented by the common *Rubus dasyphyllus* and *R. polyanthemus*. In a protected area on the reserve there is a colony of *Ophioglossum vulgatum*, and this was showing its fertile fronds.

In the centre of the Common is a marshy area, and here can be found some of the more significant species. There is a large stand of *Stachys palustris* growing with *Juncus acutiflorus*, *Senecio paludosus* and *Stellaria uliginosa*. *Dactylorhiza fuchsii* and *Pulicaria dysenterica* grow by the side of the footpath, with *Veronica scutellata*.

Malham Tarn (VC64) 5th and 6th June (D. T. Richardson and L. Magee)
The meeting on both days were well attended, with 38 people being present on the first day. Fourteen people participated in the residential meeting and they enjoyed three very busy days. Subject areas covered included botany, entomology, terrestrial arthropods, freshwater biology and microscopy. During the day participants followed their own pursuits, either individually or collectively. One group, for example, spent their time rowing round the Tarn in the glorious sunshine.

After dinner there were mini-lectures as follows: electron microscope studies of lesser water boatmen, diatoms and feather mites (D. T. Richardson and M. Smith); Mayflies (L. Magee); Stoneflies (Dr L. Lloyd-Evans); Mollusca of Malham (A. Norris); Caddis collection and identification (Miss M. Andrews); John Nowell and the Mosses of Malham (T. L. Blockeel) and Beetles (M. Denton and R. B. Angus). The remaining evenings were spent in the laboratory, identifying specimens and exchanging views – an exercise which went on into the small hours. The Field Studies Council was anxious to receive up-to-date records, and members responded by providing very comprehensive lists for the time of year.

Thanks are due to the staff of the Field Centre, not only for their hospitality and more than adequate meals, but also for giving us the run of the Centre, estate, library, laboratory and equipment.

Mammals (L. Magee)
Few mammals were reported during the weekend. A Roe Deer and two Brown Hares were seen in the woodland. There were Rabbits aplenty near Tarn House, where a Weasel was

also seen. In addition, there were signs that Foxes were in the area.

ORNITHOLOGY (M. L. Denton)

Breeding birds on the Tarn included two pairs of Great Crested Grebe and several pairs of Coot. Other species present were Little Grebe, Tufted Ducks and a pair of Teal, all of which were probably breeding. Warblers present in Tarn House Wood were Blackcap, Garden Warbler, Willow Warbler and Chiffchaff. A male Pied Flycatcher which frequented the grounds of the Field Centre had attracted a female by the Sunday morning.

A pair of Tawny Owls, which were calling at 0200 hours, keeping residents from their slumbers, was found to have newly fledged young. Wader species, all of which were probably breeding, included Oystercatcher, Common Sandpiper, Snipe, Lapwing and Curlew. The 42 Curlews (in two flocks of 30 and 12 respectively) were very unusual for the time of year and their presence in such large numbers was difficult to explain.

A pair of Peregrines at Malham Cove had two half-grown young. A wardening scheme and public information service were in operation, this being an excellent way to protect the birds, as well as keeping visitors informed about such events.

A total of 61 species was encountered during the weekend.

PLECOPTERA, EPHEMEROPTERA AND DIPTERA (K. G. Payne)

Only three species of stonefly were recorded during the weekend. These were *Protonemoura meyeri*, *Nemoura cinerea* and *Dinocras cephalotes* (in Malham Beck).

On both days mayflies were very much in evidence. Swarms of spinners were present near the Tarn and duns were plentiful in the woods. All belonged to the one species, *Cleon dipterum*. It is interesting that *C. simile* was the only *Cleon* species recorded during the 1954-58 survey. Nymphs of *C. dipterum* were captured from the bed of the tarn by the boat party. The only other mayfly recorded was *Baetis rhodani*, encountered in the nymphal stage in a feeder stream.

The writer spent most of his time trying to collect craneflies and adult caddisflies around Tarn House, parts of Tarn Moss and Ha Mire. The results were disappointing, perhaps due to poor weather which prevailed prior to the excursion.

Fifteen species of cranefly were taken over the weekend. As there are over 300 species on the British list, with 93 of those known from the Malham area, the poor success rate is clear. One species taken, *Nephrotoma appendiculata* was the only addition to the 1954-58 list.

LEPIDOPTERA (J. Payne)

The two clear, sunny days were spent out of doors and six species of butterfly were recorded. Only one male and one female Large White were seen, as were a few Small White and many Green-veined Whites of both sexes. Only one Orange tip – a male - was reported. Although *Cardamine pratensis* was seen, most of the Green-veined Whites were close to a good growth of *Cochlearia officinalis* by the inflow between the fen and Tarn Moss. A single Red Admiral and one very worn Small Tortoiseshell were also seen. It is interesting that *The Insects of the Malham Tarn Area* (1963) did not include Orange Tip, and with week-long visits held over six years such an eminent group could scarcely have missed observing the male of the species.

The writer was able to examine the catches in the Rothamstead light trap on three consecutive mornings. This produced twelve species. The commonest was The Shears with 12 individuals, the second being The Broom with 3. All others were singles. On Tarn Moss the Common Heath was flying in numbers. A large brown moth was thought to be The Fox, but no specimen was netted. Old cocoons of the (presumed) Northern Eggar were lying in tussocks in their hundreds. Although one or two were found containing old pupae, none were alive; it is thought that these were leftovers from the 1992 emergence, or possibly earlier. A total of 16 species of moth was recorded.

TRICHOPTERA (M. Andrews)

Twelve species were collected as either larvae or adults, which is about what one would expect in this sort of habitat (mainly the tarn area) at this time of year. Two species were new to the Malham list: a larva of the uncommon *Limnephilus politus* – collected from the tarn by the boat party – was reared by the writer, and *Rhaycoleptus alpestris*, which has a local distribution, was confirmed as this by Dr Hiley.

COLEOPTERA (R. B. Angus and M. L. Denton)

Among the rove beetles, *Tachinus elongatus* was found in some numbers on the edge of the Tarn in front of the Centre: this is an uncommon upland species. *Eusphalerum minutum* was found in Tarn Moss, in front of the Field Centre and at Tarn Foot. *Atheta arctica*, an upland species, provided the 9th Yorkshire record. *A. tibialis* was captured in front of the Field Centre. This species was last recorded from Malham in 1957. Other uncommon upland species included *Lesteva monticola* and *Stenus umbratilis*, the latter being found at Tarn Foot.

The water beetle *Potamonectus assimilis* was found to be common around the edge of the Tarn.

The large Chrysomelid *Timarcha goettingensis* was also found in front of the Centre; this large beetle is able to eject red fluid from its mouth when alarmed – hence its popular name of 'bloody-nosed beetle.' Only two British species are capable of this reaction. Another Chrysomelid, an uncommon upland species, was found while sweeping *Mercurialis* in Tarn House Wood on Sunday morning. Other members of the family met with were an uncommon species, *Aphthona euphorbiae*, found at the edge of the wood, and *Hydrothassa hannoveriana* at Tarn Moss; this is one of two sites in Yorkshire where it is known to occur.

The Scolytid *Leperisinus varius* was found in front of the Centre. On the Saturday afternoon two ground weevils, *Barynotus moerens* and *Sciaphylus asperatus*, were also found on *Mercurialis*.

In all, 64 species were collected along the edge of the Tarn, 37 from Tarn Moss, 21 from Ha Mire and 50 from Tarn Wood. Many additional records were made on the second day. Full lists of the species have been lodged with the Field Centre.

MOLLUSCA (A. Norris)

The molluscan fauna of Malham and the surrounding area is, without doubt, the best known for the county. The total list of land and freshwater mollusca is now in excess of 90 species. The first published records appeared in *The Land and Freshwater Mollusca of Upper Airedale* written by H. T. Soppitt and J. D. Carter and published in *The Naturalist* in 1888. Two years later W. Denison Roebuck's *The Conchology of Malham* appeared in the same journal. Since then many collectors have visited the area, with many other reports and records being published. These include many altitude records for freshwater species, Malham Tarn being one of the few high altitude calcareous lakes in Britain.

The compilation of a report on the mollusca found over one weekend is, therefore, a difficult task. The total number of species found represents about 47% of the known fauna of the area. However, if the rare species – i.e. those only recorded once or twice of the past century or so – and the very local species (those found only from the wider area) are excluded then this percentage becomes more respectable. Several of the more interesting species, some of them almost confined to the limestone crags and pastures, were refound, but *Deroceras (Agriolimax) agreste* could not be found. Of those which were located, perhaps the most noteworthy was *Vitrea (Subrimatus) subrimata* which was found under the deep-set stones on Great Close Scar.

FRESHWATER BIOLOGY (D. T. Richardson, M. H. Smith and L. Magee)

The unexpected fine weather and the calm water allowed us to sample many parts of the Tarn. LM attempted to take Brown Trout and Perch by rod and line (without success). The only fish taken alive was the Bullhead *Cotus gobbio*, but a dead Perch was found on the

margins. Immature Brown Trout were netted in the feeder stream. There was no evidence of the crayfish *Austropotamobius pallipes* which was formerly abundant. Few aquatic insects were hatching and *Cleon dipterum*, the Pond Olive, was the only mayfly seen on the wing during the weekend.

Water fleas – probably *Daphnia magna* – were present in enormous numbers, as were the crustaceans *Gammarus pulex* and *G. lacustris*.

Chara species were also abundant throughout the Tarn, as was *Myriophyllum spicatum*. The pondweed *Potamogeton lucens*, which reaches the surface later in the year, was not observed.

Water samples from the Tarn checked by DTR gave an alkalinity of 96 and a pH value of 8.7 at 15°C.

FLOWERING PLANTS AND FERNS (D. R. Grant)

The flora of the Malham area has been studied for three centuries and it would not be possible to do justice to it in a single weekend. Indeed, three or more visits at different times of the year would be essential. However, several parties of botanists were active during the weekend, and most of the estate, including the high scars, was visited. Many of the rarities likely to be seen in early summer were located. *Hornungia petraea* was seen on one of the scars. It was good to see so many young plants of the rare sedge *Carex appropinquata* on Tarn Fen. The grass *Calamagrostis stricta* and another rare sedge, *C. diandra*, were not seen, but the former was re-found later in the year. An aquatic water-crowfoot thought to be *Ranunculus fluitans* was not in flower and could not be positively identified. A search of the Field Centre's record cards showed that we were not the first to be puzzled by the plant.

Other interesting plants included a tufted variety of *Carex nigra*, *Andromeda polifolia* and *Vaccinium vitis-idaea*.

Special attention was paid to the 'lawn' area in front of Tarn House. This had previously been grazed by rabbits. More than 60 species were found, including *Viola lutea*, *Alchemilla glabra* and *Erinus alpinus*. Comprehensive lists were provided by J. Lambert, C. Johnston, J. Kendrew *et al.*

BRYOLOGY (T. L. Blockeel)

The complex area of bog, fen and carr on the northern and western sides of the Tarn has a particularly fine flora. The raised bog, however, is no longer active and its flora is therefore not especially rich. *Sphagnum papillosum* and *S. rubellum* are frequent, and *S. cuspidatum*, *S. tenellum* and a single patch of *S. magellanicum* were also noted. Bog hepatics included *Cephaloziella hampeana*, *Odontoschisma sphagni*, and both *Mylia anomala* and *M. taylori*. *Barbilophozia kunzeana*, one of the most noteworthy species of the Tarn area, was seen on wet peat in a channel.

The area to the north-west of the Tarn has excellent communities of fen bryophytes. Species noted in the mires included *Sphagnum teres*, *S. contortum*, *S. warnstorfii*, *Plagiomnium elatum*, *Rhizomnium pseudopunctatum*, *Climacium dendroides*, *Campylium stellatum*, *Limprichtia cossoni*, *Calliergon giganteum and Chiloscyphus pallescens*. In the more acid parts were *Polytrichum alpestre*, *Calliergon stramineum* and *Drepanocladus exannulataus*. In the adjacent carr there were extensive patches of *Calliergon cordifolium*, and on the trees and shrubs *Ptilidium pulcherrimum* and a little *Dicranum tauricum*.

The grounds of the Field Centre and the adjoining woodland and crags were examined. On one area of rather dry peat *Leucobryum glaucum* and *Polytrichum longisetum* were observed on several occasions. *Weissia microstoma* was found in the turf below the Centre, and *Rhytiadelphus loreus* was on the woodland floor. Epiphytes on the trees included *Ulota crispa sensu lato* in small quantity, and *Dicranum fuscescens*. The sheets of *Nowellia curvifolia*, which covered some of the rotten logs, were particularly appropriate at this locality. The genus is named after John Nowell of Todmorden, who first made known the rich bryophyte flora of the Malham district.

Shaded limestone produced *Scapania aspera, Porella platyphylla, Lejeunea cavifolia, Seligeria donniana, S. acutifolia, Oxystegus sinuosus, Zygodon viridissimus* and *Taxiphyllum wissgrillii.*

A full list of all the species noted has been supplied to the Field Centre and deposited in the Yorkshire Naturalists' Union's archives.

PLANT GALLS (L. Lloyd-Evans)

It was rather early in the season to do justice to the galls of this upland locality, but several vivid orange rust fungi – all belonging to some of the smaller genera – were conspicuous. *Trachyspora intrusa* was seen on *Alchemilla glabra, Triphragmium ulmariae* on *Filipendula ulmaria* and *Xenodochus carbonarius* on *Sanguisorba officinalis.*

Two bushes of *Prunus padus* near the lane junction at Water Houses were so infected by the fungus *Taphrina padi* that no normal berries could be seen. This is a very local gall in Yorkshire, previously only recorded from Newton Dale and Goathland.

Another uncommon, northern gall caused by the sawfly *Pontania dolichura* was found in the fen on *Salix myrsinifolia.* It is very distinctive, looking like a pair of little sausages lying either side of the leaf midrib and parallel to it.

MYCOLOGY (C. S. V. Yeates)

A reasonable selection of fungi was recorded, most of them scarcely meriting particular comment. The exception is the gall-causing *Taphrina padi* mentioned above. This is a very local fungus in Yorkshire, previously only recorded from Newton Dale and Goathland.

GRISEDALE (VC65) (D. Millward)

ORNITHOLOGY (M. J. A. Thompson)

Despite the poor weather, quite a few birds were seen, the majority being upland species. In all, 36 species were recorded by members. Waders were represented by Curlew – several of which were still calling – Snipe, a single Common Sandpiper by Grisedale Beck and Oystercatcher. Two small flocks of Lapwings were seen moving in a north-easterly direction, indicating that for this species at least the breeding season was over. As well as Pied and Grey Wagtails, a pair of Yellow Wagtails was feeding in grassland overlooking the Beck. A single Dipper was seen on the beck.

Small flocks of Redpolls, accompanying Linnets, moved up and down the dale. Summer visitors included Swifts, several Swallows still feeding young in the barns, House Martins, Wheatear, two male Whinchats, Whitethroat and Willow Warbler.

Out on the moorland areas, beside Red Grouse, there were singing Skylarks and a solitary hunting Kestrel. A small flock of Grey partridge was disturbed. One member found a Meadow Pipit's nest containing three eggs.

Close to one of the forestry areas, a single Great Spotted Woodpecker was feeding on open ground. Flocks of Woodpigeons up to 30 strong were also seen during the day.

COLEOPTERA (M. L. Denton)

The unsuitable weather thwarted any serious attempt at collecting beetles, and very few species of note were found. The weevil *Cionus scrophulariae* (both larvae and adults) was found on its food-plant *Scrophularia nodosa.* The find of the day was definitely the rare rove beetle *Lathrobium zetterstedti.* There are very few authenticated records of this upland species. Due to under-recording VC65 can usually be relied upon to provide several new vice-county records. This meeting, unfortunately, was an exception.

FLOWERING PLANTS AND FERNS (M. A. Atherden)

The delightful, remote valley of Grisedale offered a range of habitats typical of the Pennine Dales Environmentally Sensitive Area. The flora was interesting not so much because for its rarities as for the juxtaposition of species characteristic of sharply contrasting situations. Calcicoles and calcifuges rubbed shoulders on the same hillside, whilst wetland species

grew next to those requiring good drainage. The traditional farming practices fostered in the E.S.A. have enabled the survival of many hay meadow and pasture species which are now scarce on much of our farmland. Land-use is of crucial importance in determining the botanical composition, and contrasts were noticed between fields closely grazed by sheep and those grazed by cattle or horses – the latter being a particular feature of this valley. An area of former heather moorland was converted to *Molinia* grassland as a result of a single winter of unusually heavy grazing by cattle. Most of this area has now been planted with *Picea sitchensis* by the Economic Forestry Group.

The pastures on the valley sides supported a range of common grasses and forbs, often with large clumps of *Juncus effusus* or *J. acutiflorus*. *J. squarrosus* was also very common, whilst *Caltha palustris* and *Cochlearia* agg. spilled out from wetter areas onto open hillside. In small patches of wet ground *Primula farinosa* was found, unfortunately not flowering. A thin outcrop of limestone supported such species as *Thymus polytrichus*, *Arabis hirsuta*, *Pimpinella saxifraga*, *Scabiosa columbaris* and *Galium sterneri*. Acidic grassland or moorland areas were dominated by *Molinia caerulea* or *Calluna vulgaris*, with *Drosera rotundifolia*, *Vaccinium oxycoccus*, *Eriophorum angustifolium* and *Narthecium ossifragum* in boggy patches.

The hay-meadows had an unusually high proportion of *Caltha palustris* and *Crepis paludosa*, together with species such as *Equisetum fluviatile*, *Cardamine pratensis*, *Vicia cracca*, *Filipendula palustris*, *Conopodium majus*, and *Carex nigra* amongst the grasses. The streamside habitats were mostly occupied by grassland species from the adjoining fields, but species of particular note included *Equisetum sylvaticum*, *Ranunculus omiophyllus*, *Lychnis flos-cuculi*, *Chrysosplenium oppositifolium*, *Epilobium nerterioides*, four species of *Myosotis*, *Veronica beccabunga*, *Pedicularis sylvatica*, *Valeriana officinalis*, *Cirsium heterophyllum*, *Dactylorhiza maculata*, *Iris pseudacorus*, *Glyceria fluitans* and *G. declinata*. Many mature trees of *Salix pentandra* were also a feature of this habitat.

Roadside verges held a rich flora, notable species being *Chenopodium bonus-henricus*, *Rhinanthus minor*, *Achillea ptarmica*, *Triglochin palustre*, *Platanthera chlorantha* and *Dactylorhiza fuchsii*. *Asplenium trichomanes* and *A. ruta-muraria* grew on the walls. A bank by Garsdale Station and an abandoned spur of the railway also had a rich flora, which included *Cystopteris fragilis*, *Polypodium vulgare*, *Mimulus guttatus* and *Listera ovata*. These were accompanied by garden escapes such as *Aquilegia vulgaris*, *Geranium pratense* "Johnson's Blue" and *Saxifraga cuneifolia*.

MYCOLOGY (C. S. V. Yeates)

This was quite a rewarding day for the mycologist, with a number of new vice-county records being made. However, at a time when the larger fungi were scarcely in evidence the higher, acidic ground was disappointing. *Tephrocybe palustris* was very common in *Sphagnum* areas and dungy grassland turned up *Panaeolus sphinctrinus* and *Bolbitius vitellinus*. On the floor of a disused barn *Peziza cerea* – a species which can turn up on damp plaster in houses – was growing. Even more rewarding were the areas around the disused spur of the railway, where the tall vegetation ensured a profitable search for micro-fungi. Among eight species found on dead stems of *Urtica dioica*, the ascomycetes *Leptosphaeria purpurea* and *Lophiostoma angustilabrum*, and the hyphomycete *Camposporium pellucidum*, being perhaps the most noteworthy. *Centaurea nigra* turned up *Leptosphaeria jaceae* on its dead stems and *Ramularia centaureae* on dying patches of leaves. Another *Ramularia* found was *R. gei* on *Geum rivale*.

Rusts included *Puccinia major* on *Crepis paludosa*, *P. calcitrapae* on *Cirsium palustre* and *Trachyspora intrusa* on *Alchemilla glabra*.

Sheep dung was collected for incubation. Large numbers of the tiny agaric *Coprinus heptemerus* fruited a week later. Of three species of the discomycete genus *Ascobolus*, *A. stictoideus* was the most interesting.

In all, some 45 species were recorded during the course of the day.

OBITUARIES

DEREK BARNETT CUTTS (1926-1994)

Derek was born in Goldthorpe near Sheffield, and from an early age showed an interest in natural history. As a boy he built up his own small museum, which was curated in the family home. Sadly, this collection was destroyed in the war time blitz of the city on the night of 12th December 1941. He attended Nether Edge Grammar School where the school natural history society became inactive "for the duration", but he was eager to enlist in the Air Training Corps for duties which included fire watching and plane spotting, and spent school holidays cycling to RAF stations in Lincolnshire and East Yorkshire. The school had its allotment gardens, as part of the "Dig for Victory" campaign, and work in the plots was a compulsory chore. He maintained that this gave him a lifelong aversion to vegetable cultivation, but a love of gardening for pleasure and wildlife.

After leaving school, he joined a local architectural firm as a draughtsman. The senior partner recognised his ability and advised him to start an architectural course: he completed his first year at Sheffield University, and also gain valuable experience in assessing the stability of bomb damaged foundries and forges, having to ascend the roofs and report back on this condition.

In 1945 he was called up into the RAF and served in Palestine and Ceylon as an ambulance driver. He was an active field naturalist throughout the terrorist campaign which led to the founding of the state of Israel. Stand-by duties gave time for the wide reading which underpinned his many cultural interests, and his little off duty time was spent in natural history.

After demobilisation he continued his studies, qualifying as an architect in 1952, his first post being with Doncaster Borough Council. He was then active within the Hunter Archaeological Society and the Sorby Natural History Society, where he became a qualified bird ringer under the tuition of Ray Hawley. At the local tennis club he met his future wife Mollie, forming a renowned natural history and archaeological partnership. They excavated barrows and a Roman fort at Brough on Noe and were regular visitors to the newly formed Spurn Bird Observatory, forming the basis for their love of the East Riding.

In 1962 he transferred to Kingston upon Hull, where he became the Deputy City Architect. Soon after their arrival in Hull he and Mollie participated in the excavation of the famous Bronze Age boat at North Ferriby in very trying conditions. He took a cine-film of the operation, and later rediscovered in it his loft. It was turned into a video for a recent

successful anniversary event. Derek was pleased with this film, which he quoted as an example of the value of photographs as records, and lived to see its public showing in the village hall. However, their archaeological luck held out even longer. Buying a plot of land in South Cave, to build a bungalow, they discovered a Roman settlement which, of course had to be thoroughly excavated and recorded, delaying their new home considerably!

Derek developed the garden from a field of barley into wildlife sanctuary, with a large pond, and planted many trees and shrubs to compensate for the contemporary destruction of hedgerows. His career in Hull coincided with the rebuilding of the city after wartime destruction, and his austere, Scandinavian style and great attention to detail was in sympathy with the city's cultural roots, so that today, many an urban corner bears the stamp of his personality. Possibly the project which gave him most satisfaction was to design the gallery for the Brantingham Roman mosaics within the East Riding Museum, a difficult technical task where he successfully surmounted many problems. He became a member of the Yorkshire Naturalists' Union in 1965, and soon became very active in local natural history, joining the then Hull Scientific and Field Naturalists Club, the year he moved from Sheffield, and being very active both in the field and on its committees. It was largely due to Derek that the organisation became more open, and changed its title to the Hull Natural History Society. He contributed numerous notes for its journals, and the centenary year in 1980, steered most ably during his chairmanship, was a great success.

He was for many years an organiser for the British Trust for Ornithology, and put in much field work on its various enquiries, especially the first *Atlas of Breeding Birds*, ringing hirundines on the Humber, and organising the counts on the north bank for the Birds of Estuaries Enquiry.

Together with his friends Brian Pashby and Angela Gowland, he served on the Humber Wildfowl Refuge Committee for 28 years continuously until his death, holding the office of Chairman for 13 years. It is impossible to overstate the contribution which Derek made to nature conservation by his many years long service upon the Humber Wildfowl Refuge Committee. As an unpaid amateur he provided the continuity, the drive, the dedication and the capacity for hard work which enabled the Refuge to slowly build upon the statutory foundations laid down by Act of Parliament. Whether in selecting the seasonal warden, designed the observation point and overseeing its construction, liasing with landowners and local authorities, or dealing with matters of shooting permits and misdemeanours, Derek could be relied upon to treat everyone with courtesy, friendliness and unfailing good humour. He truly had the happy knack of being able to meet and converse with people from every walk of life and level of society, yet soon find a common bond of interest. His knowledge of all Refuge matters was encyclopaedic, and he was punctilious in procedural matters within the Committee. His relations with the wildfowling community were excellent. During those years, the Refuge settled down to its role as a wintering ground of international importance for birds, although the Pink-footed Goose, whose preservation was the original purpose of the Refuge, declined due to changes in farming practices.

These events were described by Brian Pashby in his presidential address to the YNU. Sadly, Brian died before he could deliver this work, and it fell to Derek to deliver the completed text in the stead of his friend. Needless to say, he performed this difficult task with his typical aplomb (*Naturalist* **117**: 81-98, 1992).

In the late 1980s it was discovered that he had a heart problem and he was forced to retire. This gave him more time to maintain his garden and to continue his fortnightly bird counts on the Humber. He started a rigorous programme of nightly moth trapping, making several new contributions to the Yorkshire list, and confirming several old records whose validity had been doubted.

The unravelling of the post-war consensus impacted upon his beloved Humber Wildfowl Refuge where the wildfowlers formed their own organisation to collect shooting permits. Derek pointed out from the outset the pitfalls in such changes, which would leave the Refuge underfunded, but lost the arguments, mainly because of apathy on the naturalists' side of the Committee. In 1994 came a further blow: English Nature were to drastically

reduce their funding of a seasonal warden. Derek announced that he would try to increase his work on the estuary to maintain effective coverage and wardening, and was never heard to complain about developments which troubled him greatly.

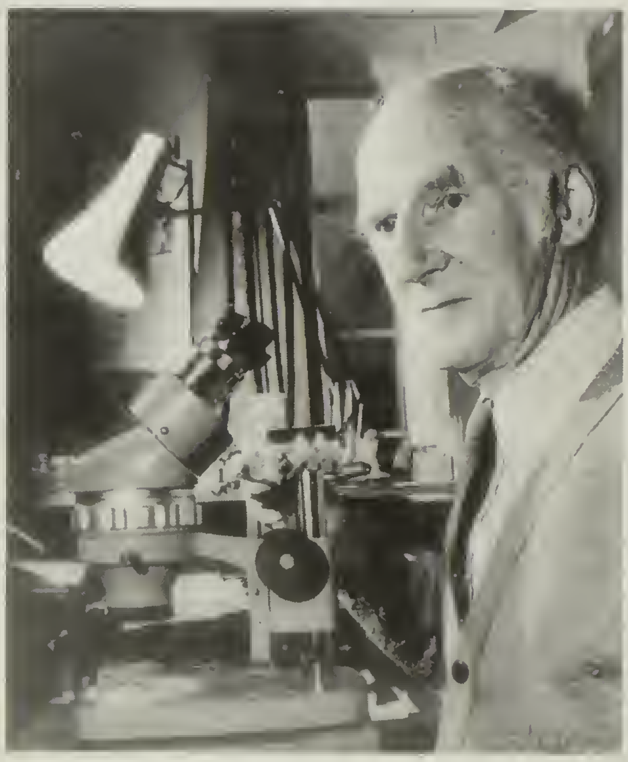
In August 1994, Derek suffered a massive heart attack in the process of draining his garden pond. By a strange whim of providence, the two people who found him and tried to render first aid were a naturalist and a wildfowler, so even in death he maintained contact with the two different ways of enjoying nature. At his funeral, all the wildfowlers organisations were represented, as well as naturalists, and it was indeed touching to see the great esteem in which he was held by all his friends.

His death leaves a great void in the running of the Humber Wildfowl Refuge, at a critical time in the affairs of that body.

Naturalists can be proud that a man of his considerable talents chose to devote his precious time to the tedious long term work of nature conservation. A collection in his memory raised £200 to buy a telescope for the temporary warden. He will long be missed by all those whose lives he helped to enrich, and the YNU extends its heartfelt sympathy to Mollie, and his son Nick.

R. A. Eades

CLIFFORD JOSEPH SMITH (1915-1995)



Clifford Smith, a stalwart of the YNU for many years, died on 2nd April after a fall. He was in his eightieth year. Born on 22nd October, 1915, Clifford attended the local Quaker school in Saffron Walden, Essex, although he was not at that time a member of the Society of Friends. He went up to Cambridge in 1934 to read Natural Sciences and on graduating spent a further year in the University of London gaining a teaching diploma. His first post as a schoolmaster was at Haberdashers Askes Hatcham School, London, where he taught for four years. In 1942 he moved to a teaching appointment at Bootham School in York,

ıs maintaining his Quaker links. Clifford remained on the staff at Bootham School, at st as the biologist and later as head of the biology department, until his retirement in 77. With his wife, Joan, Clifford joined the Society of Friends sometime during the 50s.

Clifford was one of the pioneers of the County Wildlife Trust movement and the present ırkshire Wildlife Trust (YWT), in all its complexity and activity, is a tribute to the vision Clifford and a small band of concerned individuals back in 1946. The YWT (or ırkshire Naturalists' Trust as it was then) was only the second county trust to be formed Britain and the impetus for its creation was the conservation of Askham Bog, 'the finest ample of natural wooded fen in the north of England', which became the Trust's first ure reserve. Clifford was the first Honorary Secretary of the Trust, running operations m his home, and relinquished the post only when increasing membership and business ant that a paid executive officer had to be appointed. He held a number of other key es within the Trust and was elected its third President. Clifford's interest in Askham Bog s maintained throughout this period – he sampled it intensively for spiders and with stair Fitter co-authored *A Wood in Ascam – a study in wetland conservation* (1979).

In 1962 Clifford joined the YNU and in 1964 its Arachnida Committee (renamed the ıer Arthropod Committee in 1968), as spider recorder for the Union. This Committee l been established by the well known Yorkshire arachnologists W. Falconer and T. ınforth in December 1909; Clifford's work therefore extended the virtually unbroken dition of spider recording in Yorkshire over almost 90 years. In 1980 he was elected sident of the YNU and, not surprisingly, his Presidential address was entitled *Spiders in rkshire* (*Naturalist* **106**: 45-52 (1981)). His main theme was the changes in the rkshire arachnofauna over time, and he drew heavily on the solid foundations Falconer l laid in the early part of the century.

Clifford's interest in spiders began early. While teaching at Bootham School he had little ɔortunity to work on them although he encouraged boys who lived in, or were visiting, eign parts to collect specimens. He joined the embryo British Arachnological Society en the Flatford Mill Spider Group) in 1960, soon after its formation, being one of just 24 mbers recorded in January 1961 (FMSG *Bulletin* No. 9). His first article for the FMSG *'letin* appeared in issue No. 10 (April 1961) entitled 'Two rare spiders from Askham g, Yorkshire'. Since that time he generated a gentle flow of communications for the S *Newsletter* as well as articles and reports for the present BAS *Bulletin*, *The Naturalist* l the YNU *Bulletin*.

British arachnologists will long remember Clifford for three principal reasons. Firstly for *An Atlas of Yorkshire Spiders*, privately produced in 1982; this was, and still is, the y county atlas of spider distributions to be published and represented a monumental ount of work when one considers the size of the county and the fact that all the maps e generated by hand. Clifford was the first to admit that computers were totally beyond ı! Leading on from this, it was only natural that Clifford should have been involved in establishment of the National Spider Recording Scheme (SRS) launched in April 1987. acted as National Organiser until ill health forced his retirement in 1993. Last, but by means least, one contribution Clifford made to arachnology will be remembered sonally by very many people – the warmth, patience and encouragement he extended to se beginning the study of spiders as well as to more experienced workers.

Clifford was a true gentleman who offered help, advice, friendship and wisdom in his ı quiet and humorous way. He disliked the pompous and the garrulous and had his own ı but courteous techniques for dealing with both. His modesty was demonstrated to me en, after helping to organise a large house spider survey of Yorkshire and spending ch time identifying and measuring the specimens generated, he suggested the resulting er should be in my name alone 'because he hadn't done much towards it'. That was a le I made sure he lost. Perhaps the most enduring feature of Clifford's personality was concern for others over that for himself. Even when quite ill in the latter years of his , enquiries about his health were quickly and cheerfully brushed aside – he was much

more interested in how other people were and what they were doing. Clifford's death is a very sad loss for nature conservation in Yorkshire, for the YNU and for the numerous friends who held him in such esteem. On behalf of the Yorkshire Naturalist' Union I should like to express our sincere condolences to Clifford's wife, Joan, and to his family.

Footnote: I would like to thank David Nellist, John Newbould, Doug Richardson and Joan Smith for patiently supplying details of Clifford's life.

Geoff Oxford

BOOK REVIEWS

Records of Dinosaur Footprints on the North East Yorkshire Coast, 1895-1993 by **C. R. Ivens** and **G. G. Watson.** Pp. 20, including several small black and white and colour plates, line drawings and one table. 1994. Roseberry Publications, Middlesbrough. £3.95.

This little book was written to commemorate one hundred years of records of dinosaur footprints on the Yorkshire coast. The first find occurred in 1895 at Cayton Bay, followed by further discoveries in 1907 at Saltwick Bay. Since then, amateur and professional geologist have made discoveries with increasing frequency and of great variety. The finds of 25 separate sets of footprints are described in this book, with details of the probable species which made them, the rock strata in which they occurred and interpretative details of the behaviour patterns indicated. The last of these are, perhaps, of greatest interest to the general reader. Footprints can not only tell us the size, weight and method of locomotion of the dinosaurs but can also give tantalising clues about social groupings, environmental conditions and evolution of the species.

The book is clearly written and nicely presented but at only 20 pages long it is little more than a checklist of finds. As such it is a valuable summary for geologists or palaeontologists working in the area but provides only skeletal details of the wider context of the finds. It certainly succeeded in whetting the appetite of this reviewer. Perhaps we can look forward to a longer, more wide-ranging volume on this fascinating topic in the near future?

MAA

Animals of Sandy Shores by **P. J. Hayward.** Pp. 104, with numerous line drawings & 4 colour plates. 1994. Richmond Publishing, Slough. £16.00 hardback, £8.95 paperback.

This excellent book is number 21 in the Naturalists' Handbook series, which is aimed at a mixed readership of advanced school/university students and amateur naturalists. Written in a clear, concise style, with technical terms defined in the margins, it is easy to read and extremely informative. Five introductory chapters cover the evolution and physical features of coasts; the problems for invertebrates of living in sand; the distribution, zonation and biological rhythms of the organisms, and their methods of reproduction, competitive strategies and feeding relationships. They provide an admirable summary of a vast range of research, appropriately referenced.

The sections which follow are concerned with identification of the animals themselves. A useful quick-check key identifies the main groups, which are then described in the text. This leads on to more detailed keys of all the groups, accompanied by black and white line drawings of each species and colour plates of a smaller selection of organisms. The illustrations are one of the great strengths of this book and are reproduced to a high standard. The book closes with a chapter on fieldwork techniques, sampling strategies and methods of analysis, followed by a list of useful addresses and a comprehensive list of further reading.

The very high quality of presentation and large number of illustrations make this a very useful and attractive book. Small and light enough to be easily carried in the field, it will be an indispensable identification book for seashore naturalist as well as a valuable addition to any natural history library.

MJD

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record this deep appreciation of this imaginative gesture.

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FACTORS LIMITING THE DISTRIBUTION AND POPULATION SIZE OF TWITE (*Carduelis flavirostris*) IN THE PENNINES

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ABSTRACT

Habitat use by a small sample of the internationally important twite population of the South Pennines was investigated between 1989 and 1994. Their use of available upland habitats varied with the stages of their breeding cycle, and the availability of seeds from a variety of food plants.

Nesting colonies were always associated with rank moorland vegetation. Species-rich hay meadows and other seed-bearing habitats such as unimproved pastures and disturbed ground were used for feeding. These habitat elements, when found in close association, in areas with a surface geology which supplies grit and water, may explain the range of the twite in the Pennines and elsewhere.

Further, the presence of species-rich hay meadows may be the factor which determines the local distribution and abundance of twite populations. Recent indications of a population decline could be attributable to a decline in hay-making, and agricultural improvement of hay meadows and pasture.

INTRODUCTION

The twite has a remarkably disjunct world distribution. As a breeding bird in Europe it is virtually confined to Britain and western Norway; these populations are completely isolated from the main range of the species in south-west and central Asia. Even within Britain, the South Pennines population now appears to be separate from that in North West Scotland, as a result of long-term population decline (Brown *et al.* 1995). The isolated South Pennine population is, therefore, considered to be of international importance.

Observations on habitat use and the food plants of twite in Britain and Norway have been published by several authors (Orford 1973; Nuttall 1972; Newton 1972; Marler & Mundinger 1975; Spencer 1977). In Britain most of the work has been carried out in the South Pennines, where birds nest in different types of unenclosed moorland vegetation and occasionally in rock crevices, trees and stone walls, and feed on nearby pastures and meadows, quarry bottoms and disturbed ground, canal sides, playing fields and burned patches of grass moorland. In Norway, rocky crevices were found to be the favoured nesting site, with feeding habitats similar to those in Britain.

Little detailed information is available on the factors which explain the range and local distribution of twite within the uplands, and which may limit its population size. Observations from this study, carried out in the breeding seasons of 1989, 1991, 1992, 1993 and 1994, give a new insight into what these factors may be.

STUDY AREA

Observations were taken from a core study area of *c.* 50km^2, with searches for post-breeding flocks of twite extending to 20 km from the central area to the west of Halifax, West Yorkshire. The core area contained three loose twite breeding colonies, varying in size from year to year, but probably totalling between thirty and fifty pairs in a good breeding season. Two of these colonies, (maps 1 and 2), were studied in detail.

The central study area is characterised by unenclosed moorlands dominated by *Molinia caerulea*, *Calluna vulgaris*, *Eriophorum vaginatum*, and *Pteridium aquilinium*. The moorlands are surrounded by pastures, many of them unimproved, which are grazed by sheep, cattle and horses, and meadows which are harvested for silage and hay. The underlying geology is dominated by millstone grit, with frequent rocky exposures. Small reservoirs are present and rivers, streams and springs are common.

Methods

Observations of feeding flocks and breeding behaviour were recorded by walking and driving through all upland habitats within the study area. Recording of feeding data in this way began in earnest in 1992. A feeding observation was recorded as a single record irrespective of the number of birds involved.

Standard routes through, and time periods spent in, each habitat were not adopted as it was felt that within limited field time available this approach would inhibit locating birds in all habitats within the study area. To ensure that as representative a sample of feeding and nesting birds as possible was obtained, all available habitats were consistently searched throughout the season, irrespective of the stage of the breeding cycle.

Nests were located by observing paired birds and by walking through suitable habitat to flush incubating females. Over 350 hours were spent in the field during the course of the study.

Results

Pre-Breeding Flocks

Twite were found to congregate in pre-breeding flocks within a radius of 1-2km of the main breeding colonies. At colony A (map 1) flocks of thirty to forty birds were present as early as 16th March on the first visit of 1991 and were present on all first visits in subsequent years, which were made in the first week of April. At colony B (map 2), pre-breeding flocks did not appear until late April, or even early May.

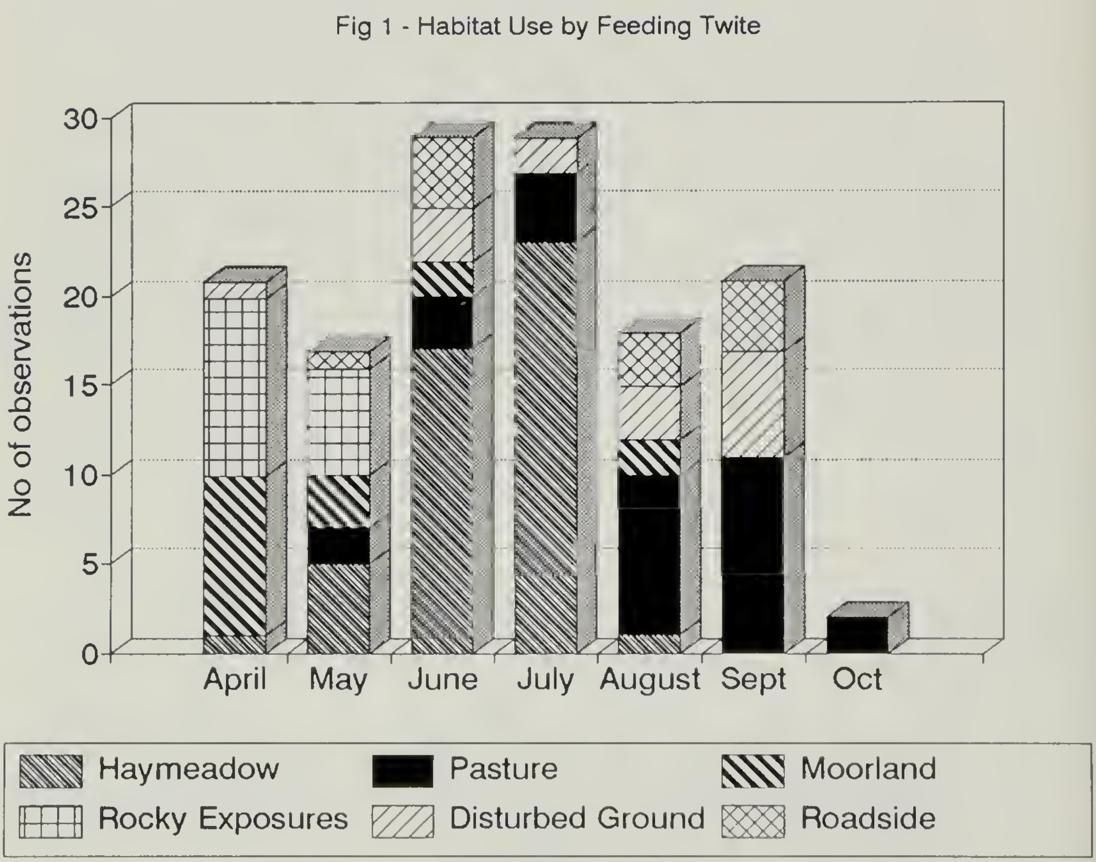


FIGURE 1
The number of feeding observations in each habitat are shown as part of the total number of feeding observations for each month.

Observations of pre-breeding flocks were taken mainly from area of colony A (Map 1). In April pre-breeding flocks were found feeding mainly on rocky exposures, including reservoir shores and farmyards, but especially in a quarry within 500 metres of the main colony; and on areas of burned *Molinia*-dominated moorland, also within 1km of the central area of the same colony (Figure 1). It was not possible to determine upon what the birds were feeding on rocky exposures, but on burned *Molinia* they could be seen taking *Molinia* seeds exposed by burning.

The behaviour of feeding flocks at this time was typified by short periods of feeding, followed by periods of resting on dry-stone walls, fences, telephone cables, heather or bracken. Pairs appeared to have already formed by the time of arrival on the breeding grounds and, within flocks, pairs could easily be identified, with the male spending much more time than the female watching for predators when feeding. Display flight was also commonly observed during this period. Flocks were observed roosting on a rocky exposure, on a boulder scree and in a bed of dead bracken fronds during this period.

In late April and through May, pre-breeding flocks and breeding pairs following flock dispersal began to spend more time feeding in developing hay meadows and were also seen feeding in pasture (Figure 1). Birds were observed taking mainly developing seeds from closed and seeding *Taraxacum* spp. heads. Rocky exposures remained important as a feeding habitat in May, as did moorland, with birds continuing to feed on burned *Molinia*.

Between the beginning of April and mid-May a total of 31 observations of feeding birds were made, of between 1 and 35 birds, comprising 383 birds in total. The mean flock size at this time was 12.36 (Table 1), with feeding flocks being noticeably larger in 1994 than in 1993 and 1992.

TABLE 1

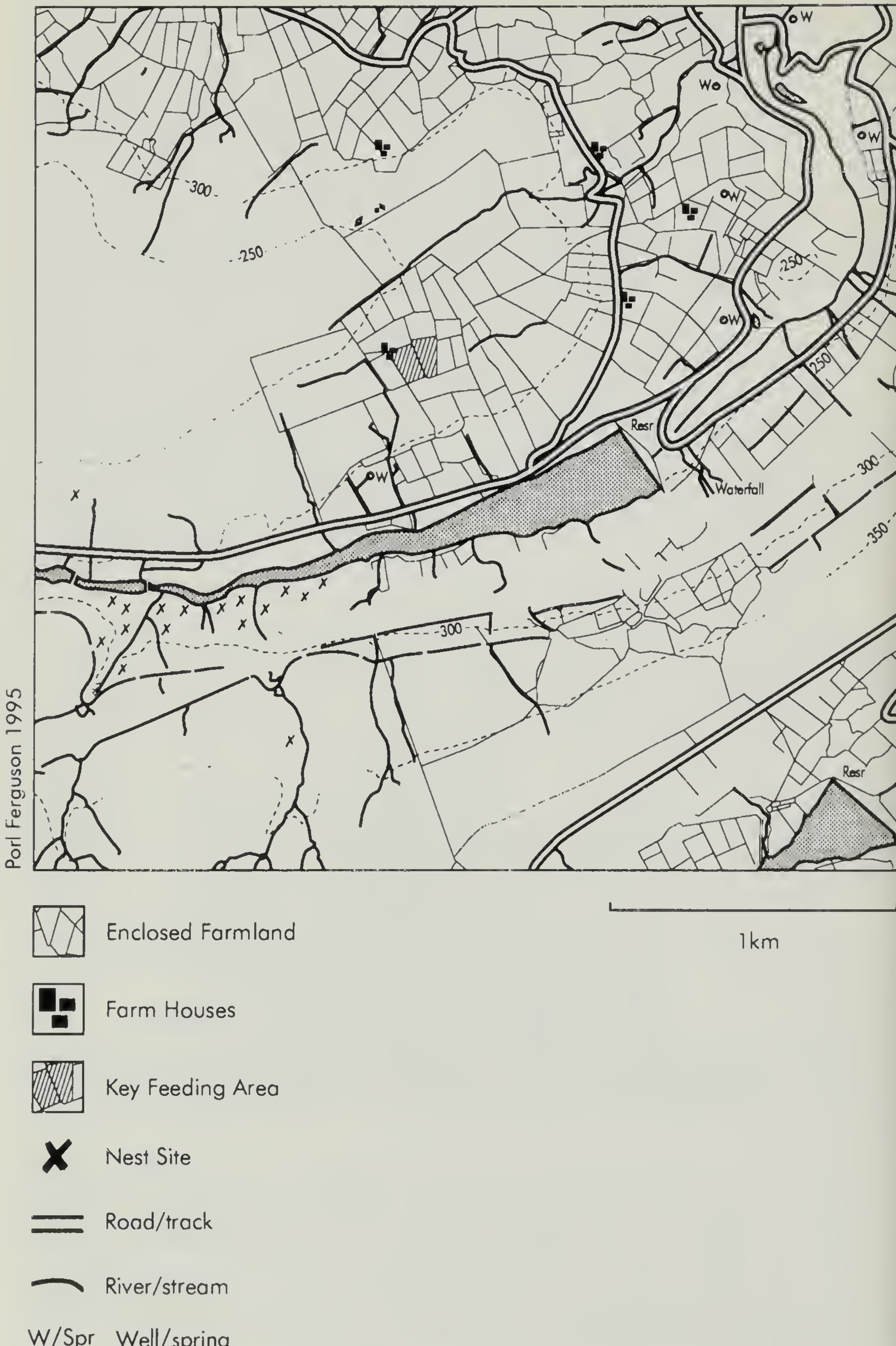
Pre-Breeding Flock Sizes 1992 – 1994

Year	Number of Flocks	Total Number of Birds	Mean Flock Size	Median	Std Error	Quartiles
1992	10	87	8.70	7	2.65	2, 14
1993	7	49	7.0	5	2.39	4, 8
1994	14	247	17.64	17	3.79	3, 35
1992-94 inclusive	31	383	12.36	8	2.13	3, 20

Nesting

Nest building and egg laying commenced soon after pre-breeding flocks broke-up, around mid-May, with the first completed clutches being found on 11th May 1993 and the last completed clutch believed to be a first clutch, being found on 11th June 1994. Small parties of male birds were occasionally seen feeding together, or fighting, presumably while the females were incubating. Much less time was spent looking for second clutches and none were found.

Twenty-seven nests were found during the course of the study with an average clutch size of 5.17. It appeared that one egg a day was laid and incubation appeared to be undertaken solely by the female. All nests were located on unenclosed moorland with a peat substrate, at an altitude of around 300 metres. Twenty-four of the nests were located within the two loose colonies within the study area (Maps 1 and 2), with individual nests being separated by a distance of between 10 and 500 metres. Two nests were relatively isolated, and were separated from the main nesting areas by a distance of about 1 km. The final nest was found in an outlying colony, which was visited only once.



Map 1. Twite Colony A.

Map 2. Twite Colony B.
Maps 1 and 2 show the relationship of the major habitat elements in the vicinity of the colonies, and of nest locations to main feeding meadows.

Most of the nests were located in bracken (Table 2), and either in long or newly burned heather, with nests also found in *Molinia* and *Eriophorum*. Nests in heather were in areas with the tallest available plants at around 50cm. Most nests were probably found in bracken because the colony which was studied for the longest time was located in an area dominated by it.

TABLE 2

Habitat Locations of Nest Found

The number of twite nests in each habitat found to be used by nesting twite 1989 – 1994

SUBSTRATE	Bracken	Long heather	Burned heather	*Molinia*	*Eriophorum*
No of Nests Found	20	3	2	1	1

A distinct change in the habitat used for feeding became apparent through the incubation and nestling stages, and while young were dependant on adults in the immediate nest area (Figure 1). There was a gradual reduction in the use of moorland and rocky exposures and a marked increase in use of species-rich hay meadows. By July, records of birds feeding in hay meadows had risen to 79.3% of the total and no birds were recorded on rocky exposures or moorland. Most nest sites were within 1500m of meadows, with meadows closest to the nest sites being used most frequently, and within 1000m of pasture land. At one colony on heather moorland, the nest closest to the adjacent main feeding meadow was about 200 metres away. Adults feeding young could easily be observed commuting between hay meadows and the nest site. Feeding birds were always observed in the most species-rich meadows and improved meadows were generally avoided. Maps 1 and 2 identify the main feeding meadows used by birds from the two colonies.

In the early part of the nesting period, when most pairs would be incubating, it was very difficult to see what the birds were feeding on, particularly when in meadows. On occasions when it was possible to observe birds feeding in hay meadows, birds were found to be taking mainly *Taraxacum* seeds. Birds were also seen taking seeds of unidentified grasses, *Stellaria media*, *Senecio vulgaris* and *Ranunculus repens* from meadows, pasture, disturbed ground and roadsides. Birds were seen feeding occasionally on moorland in June, taking *Calluna vulgaris* (presumably buds), *Juncus squarrosus* seeds and were observed feeding newly fledged young on *Eriophorum vaginatum* seeds. From mid-June through mid- to late July, *Rumex* spp. in hay meadows and also in pasture, along roadsides and in disturbed areas, appeared to comprise the staple food source. There was an increase in the number of sightings of birds feeding along roadsides in June, which appeared to be mainly accounted for by birds taking grit.

Most observations were made of feeding individuals and pairs in hay meadows, and due to the dense cover it was not possible to determine accurately the number of feeding birds in any one meadow.

Observations of adults feeding young at one nest showed that the pair of adults arrived at the nest together and took turns feeding the young and removing faecal sacs before leaving together, usually stopping to drink in a nearby stream before returning to the feeding grounds. Display flight was noted several times during the period when young were being fed in the nest.

Post-breeding Flocks

Family parties of birds could be seen to be associating in flocks from mid- to late June onwards. Flock size gradually built-up over the next three to four weeks, with a maximum

estimated flock size of 200 birds recorded in an uncut hay meadow feeding on *Rumex crispus*, near one colony on 15th July 1992. The flocks were observed to break- up in the evening during this time and family parties were seen to roost together as individual groups scattered across the moor in long heather, possibly close to their nest sites.

Post-breeding flocks began to be recorded in pasture, especially that lightly grazed by cattle or horses, much more frequently in late July and early August (Figure 1). The shift from meadow to pasture appeared to take place before the major feeding meadows had been cut, and pasture became the most frequently used habitat until the last birds had left the breeding area in early October. Observations of feeding birds in these flocks during this period indicated that they moved away from *Rumex* at the end of July and began to rely on a wide range of weed seeds in pastures, disturbed ground, especially around farm buildings and along roadsides.

Flocks became more difficult to detect from late July, and especially in the first two weeks of August. When flocks were picked up again, following moult, they were found feeding mainly on *Cirsium arvense* but were also seen taking seeds from *Stellaria media*, *Polygonum aviculare*, *Hypochoeris radicata*, *Senecio jacobaea*, *Senecio vulgaris*, *Taraxacum* spp., *Matricaria matricioides*, *Cirsium vulgare*, *Capsella bursa-pastoris*, *Atriplex patula* and *Sonchus oleraceus*.

Flocks were found to congregate in traditional post-moulting feeding areas. These areas were either in pastures and other habitats adjoining the (now cut) hay meadows where they had been feeding earlier, or in pastures, disturbed ground and along stretches of roadside, some distance away from the breeding areas, where twite had not been seen earlier in the season. On two occasions small flocks of twite were observed feeding on burned patches of heather moorland as part of mixed flocks of meadow pipits and linnets, presumably feeding on heather seeds. There was some variation in the degree of importance of particular food plants from year to year, with birds relying on thistles much more in 1992 than in any other year.

Flock size began to diminish following moulting, through August and September, until by the end of September most birds had left the hills. The decline in twite numbers corresponded to a change to much wetter and windier weather patterns, which were found to destroy thistle seed heads. Reports of small wintering flocks of twite within the study area were, however, received annually. Between the beginning of July and early October a total of 65 observations of feeding birds were made of between 1 and 200 birds, comprising 1486 birds in total. The mean flock size over three years was 22.86 (Table 3). As in the pre-breeding phase, mean flock size varied considerably from year to year, with flocks in 1994 being noticeably smaller than 1992 and 1993.

TABLE 3

Post-Breeding Flock Sizes 1992 – 1994

Year	Number of Flocks	Total Number of Birds	Mean Flock Size	Median	Std Error	Quartiles
1992	27	693	25.74	8	8.11	5, 29
1993	25	740	29.60	20	5.35	10, 50
1994	13	51	3.92	4	0.50	2, 50
1992-94 inclusive	65	1486	22.86	10	4.08	5, 26

Discussion

Results of observations made in this study show that twite nest in a variety of vegetation types on unenclosed moorland and indicate that these nest sites are associated with the close proximity of species-rich hay meadows, unimproved or semi-improved pasture, water sources (streams or reservoirs), rocky out-crops, farm buildings, disturbed ground and *Molinia*-dominated moorland. Pasture grazed by cattle or horses, as opposed to that grazed by sheep, seems to be favoured, perhaps because of a more uneven sward which allows more plants to set seed and because larger animals break-up the ground, encouraging weed species such as *Stellaria media*.

Observations of feeding birds show that each habitat has particular significance at different times of the breeding cycle, as seeds of the different food plants become available.

Rocky out-crops and disturbed ground, road sides and burned *Molinia* moorland, which are likely to harbour fallen or wind-blown seeds, are of particular significance in the pre-breeding phase. Absence of pre-breeding flocks in March and early April at one breeding colony at least, and survey at another revealing far fewer nesting pairs than would be expected from the size of the pre-breeding flock, suggests that twite have traditional gathering grounds in areas with abundant food and disperse from these areas to breed elsewhere as other seed sources become available.

Species-rich hay meadows are of crucial importance during the incubation period, while young are in the nest, and for some time after they are fledged. At this time the major food sources are firstly *Taraxacum* spp and later *Rumex* spp. Following fledging, birds congregate in hay meadows and feed mainly on *Rumex* spp. until dispersal when post-breeding flocks feed on weeds in pastures, by road verges and on disturbed ground. The size of post-breeding flocks, which varied considerably from year to year, appeared to reflect weather conditions and consequent breeding success, with 1994, a particularly wet and windy breeding season, being a noticeably poor year for breeding success. The annual variation in timing of breeding activity also appeared to be weather-dependant.

The results of this study corroborate much of what has been found previously, but highlight the previously unrecorded importance of the close proximity of species-rich hay meadows to suitable nesting habitat in determining the distribution of twite and the within-season variation in use of the upland habitats available.

Orford (1972) observed that twite nest mainly in vegetation on open moorland, and occasionally in rock crevices and trees, but feed in pastures and meadows, and also on reservoir dams and the grassy floors of abandoned quarries and burned *Molina caerulea* grassland, with post-breeding flocks feeding on pastures. No detail is given, however, on the plant species taken or the relative importance of the habitats described.

Nuttall (1972) and Spencer (1977) also discussed the importance of quarries, reservoirs, shores and dams, disturbed ground, canal sides and playing fields. They also described some of the important plant species taken by post-breeding flocks including *Taraxacum* spp, *Ranunculus repens*, *Stellaria media*, *Cirsium arvense*, *Senecio jacobea* and *Leontodon autumnalis*. They do not, however, recognise the importance of species-rich hay meadows or of *Rumex* species as a food plant.

Similarly, Newton (1972) points to the weeds of pasture and of cultivated land as providing much of the food of twite in summer and mentioned *Taraxacum* spp. and *Cirsium* spp., amongst others, as being favoured. Again, the importance of species-rich hay meadows is not referred to.

Brown *et al*. (1995) demonstrated that the distribution of twite nests is associated with streams, grass moors and areas where the sward is high towards the edge of unenclosed grass moorland, and that negative associations were found with areas of flush vegetation. Marler and Mundinger (1975) refer to the importance of *Taraxacum* spp., followed by *Rumex* spp., usually near villages, as food plants of twite in Norway. While cultivated fields are referred to, they make no specific mention of these plants growing in hay meadows. Brown *et al*,(1995) suggested that the reliance upon enclosed pastures for food

may underline the strong association of twite with the moorland edge. Once again, these authors do not recognise the importance of species-rich hay meadows.

The results of this study, in conjunction with the findings of Orford and Brown, indicate that twite nest in a variety of rank vegetation types on unenclosed moorland. More work is needed to establish the preferred vegetation type for nesting.

This study strongly suggests that rank vegetation is positively selected for by nesting twite, but that they will nest in low grassy vegetation if ranker vegetation such as bracken or heather is unavailable. This, combined with the fact that twite are known to nest in rocky crevices in Norway and occasionally in Britain (as well as in trees), suggests that twite distribution is not determined by the availability of nesting habitat. In the Pennines it is suggested that the availability of species-rich hay meadows, within a landscape containing relatively unimproved pastures, rocky out-crops, disturbed ground and a supply of grit and water, in close association, may be the most important limiting factor determining the local distribution and abundance of twite. Further, the combination of all these habitat elements may explain the distributional range of twite in England. Observations taken during a short excursion to the Isle of Tiree in May 1994, strongly support this suggestion, with pairs nesting in heather found to be feeding almost exclusively in species-rich hay meadows.

It is possible that the relative low density of breeding twite (Orford 1973; Brown *et al.* 1995) in the central part of the Peak District is the result of a relatively low availability of species-rich meadows and unimproved pasture, despite the presence of a geology dominated by gritstone and an abundance of water. Likewise, twite are unlikely to be found in high densities in limestone areas, such as in the Yorkshire Dales, as these areas have relatively poor supplies of water and grit, despite the availability of suitable nesting and feeding habitats.

Brown *et al.* (1995) also suggest a possible decline in the twite population since 1988 and a decline in brood size in the south Pennines, and refer to the loss of twite from previously known breeding sites. The suggested population decline is corroborated by visits made to moors which were once known to hold good populations of twite, as part of this study and by personal communications with field workers in the central and northern part of the Peak District and in the Forest of Rossendale, where a decline of breeding pairs and post-breeding flocks has been noted since the mid-1970s. Brown suggests a numbers of possible reasons, including the improvement of pasture and a decline in traditional moorland management. The results of this study would suggest that rather than a change in moorland management, it is the conversion of hay meadows to silage and continued improvement of pastures which is likely to be responsible for any decline and for the loss of twite from previously known breeding areas.

Conclusions

The results of this study indicate the habitat requirements which are most likely to explain the distribution of twite in the Pennines are an underlying geology which can supply grit and a ready supply of water, and an intimate upland landscape which can provide successive crops of seeds from a variety of habitats, especially relatively unimproved pastures. Within such a landscape, the local distribution and abundance of twite is likely to be determined by the availability of species-rich hay meadows in close proximity to rank moorland vegetation. Further study, particularly a quantitative study of habitat selection, will be required to substantiate these conclusions. The findings do, however, provide a clear focus for further studies of the details of the ecology of this species, which will enable correct habitat management in the Pennines.

Acknowledgements

I am indebted to a number of farmers for permission to carry out my study on their land. I would also like to thank John Armitage for initiating my interest in twite; Andy Brown and Lennox Campbell for providing guidance on writing-up my findings and all the above named, along with Simon Bates, Henry McGhie, Ken Spencer, Bill Sutherland and Eric Ward, for advice and comments.

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BOOK REVIEWS

Bird Life of Woodland and Forest by **Robert Fuller**. Pp. 244, with many photographs, line drawings and diagrams. Cambridge University Press, 1995. £24.95.

This publication, based on sound scientific fact, is presented in an attractive and well designed format and provides a thorough appraisal of the woodland environment in Britain. With only 10% of the entire land surface covered by trees, Britain is the least wooded country in Europe. Nevertheless, 52 species of birds manage to breed regularly, with a further 17 breeding in open scrub and young forestry and 18 which breed in the woodland but feed in other open habitats, e.g. Grey Heron. There are chapters on Historical and European Perspectives, How birds use woodland, their abundance and different types of cover, such as scrub, broadleaf, coppice and conifer. Appendices include a list of all the species using woodland, including their habitats, nest sites, food and feeding methods. In an era of increasing devastation in the countryside, this will be an important reference work for future planners and a baseline indication of how things were in the 1990s.

JRM

Travels and Nature Loves of Mary Baldwin edited by **Annette Hall**. Pp. 46, with numerous line drawings. Privately printed, Preston, 1994, £3.00, paperback (30p postage); available from Roslyn Horse, 30 Brownedge Lane, Bamber Bridge, Preston, Lancs. PR5 6TB.

This slim volume consists of the edited personal diaries of Mary Baldwin, a Lancashire schoolteacher, written during quite different holidays. The first section concerns two visits to Skomer Island and includes such vivid descriptions of the Island and its birds that the reader enjoys the writer's experiences. The second is of a visit to the Holy Land, when Miss Baldwin again uses her descriptive flair to great effect, thus conveying what, to her, was a most moving experience.

The book is illustrated with line drawings by Annette Hall and Martyn Hanks, and together with Mary Baldwin's accounts of her delightful experiences, will surely appeal to those in the Preston and Barber Bridge areas, to whom she was known personally.

AM

RELATIONSHIP BETWEEN PLANT AND INVERTEBRATE RICHNESS IN UPLAND PONDS IN MID WALES

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Introduction

The ecology of small bodies of water in the British uplands has been relatively poorly studied. The work described in this paper forms part of a more wide-ranging investigation of upland ponds in Powys, mid Wales, designed to provide a basic description of their ecology and conservation importance (Sanderson & Wilkinson, 1989; Slater, 1993; Slater, Helmsley & Wilkinson, 1991). The aim of this paper is to detect a possible relationship between invertebrate and plant species richness. Such a relationship is of particular interest in evaluating sites of conservation importance where often only vegetation data are available. A positive correlation between plant and invertebrate species richness would result in sites chosen for conservation because of high plant richness also being rich invertebrate sites. This is of particular interest for Britain where 'Botanists have long dominated conservation management' (Hambler & Speight, 1995). Support for a positive correlation between numbers of invertebrate and plant taxa was found in studies of ponds in the Isle of Purbeck, Dorset (Friday, 1987) and Norfolk breckland (Palmer, 1981), but such a relationship appears to be by no means universal. Lawton (1987), for example, described a freshwater site on the River Derwent near York which had a high diversity of plants but low invertebrate diversity.

The present study was carried out in the hills east of the River Wye in mid Wales. These hills range in height from 300 to 500m and are mainly formed from Silurian Shales. The general ecology of the area was described by Slater (1988) and Woods (1993). The ponds were shallow and often ephemeral, many drying out during the course of a summer. The water in the majority of the ponds had a circumneutral pH, a small number were on blanket peat and had acidic waters whilst one was found in what was considered by Wilkinson (1988) to be an old marl pit with water of pH 8.1. The phytosociology of these ponds has been described by Slater *et al.* (1991) and a pitfall trapping study of the beetles around the margins of four of the ponds was described by Sanderson and Wilkinson (1989). They found a lack of a discrete boundary to the water beetle communities in these ponds, with members of the Dytiscidae and Hydrophilidae being caught in pitfall traps around the pond margin.

This paper compares plant species richness with a measure of general invertebrate taxa richness and with water beetle species richness.

Methods

Water samples were collected in late June and early September 1987, chemical analysis being carried out by the Welsh Water Authority. Field measurements of pH were only available for the September sampling date. Full water chemistry results were given by Slater *et al.* (1991).

As many of the ponds in the sample showed great seasonal variation in water level there was no easy definition of aquatic plants, but for the purposes of this study all species of higher plants and bryophytes which were thought likely to be covered by standing water at some time of the year were considered to be 'aquatic'.

Discrete habitats in each pond (submerged vegetation, emergent vegetation, mud, shingle, inflow and outflow) were sampled for invertebrates by sweeping with a standard pond net for one minute. Initial trials, carried out by taking replicate samples until no new

taxa were caught, showed that single one minute sweeps caught at least 82% of catchable taxa. Friday (1987), sweep-netting in ponds in Dorset, obtained a similar catch success of 95%. In both cases it is possible that some groups (e.g. small detritivores) were not sampled by the sweep netting method used. Most groups, such as Hemiptera and Coleoptera, were identified to family level while others, such as the Mollusca and Trichoptrea were identified to species. These identifications were summed to give invertebrate taxa richness. Although there are problems with the interpretation of data when taxa richness is represented mainly by identifications to taxonomic levels higher than species, such a list often provides all the available invertebrate data for a given site. It is therefore of interest to know how such a list related to other measures of diversity. Subsequently G. Foster has identified the Coleoptera to species level.

The invertebrates were sampled twice during 1987, at the end of June or beginning of July and at the beginning of September. However, it was found that 20% of the ponds had dried up by September so no water or invertebrate samples could be taken. In consequence the September results (except for pH which was not measured in June) are not presented in this paper, invertebrate data for June/July being used for comparison with the plant data. Nevertheless for those ponds which did not dry out the same relationships obtain in September as in June/July.

There are several possible statistics which could be used to examine the relationship between invertebrate and plant diversity, the simplest being species richness: serious problems are often claimed for his measurement since it is dependent on size of the sample and the time spent searching (Usher, 1983). In the present case, since the ponds were searched until no new species of plants were found and the invertebrate sampling methods was shown to catch 82% of all taxa catchable with a sweep net, these objections to the use of species richness are less valid. This highlights the importance of ponds for such studies, being discrete sites which are relatively easy to sample. An alternative measure would be to use one of the many different diversity indices. Both the Shannon and the Simpson indices were calculated (Southwood, 1978; Usher, 1983) however, when calculated for the invertebrate data these indices were greatly affected by the presence or absence of dense clouds of Crustacea, such as Cladocera, which could outnumber all other invertebrates in a sample by two orders of magnitude. In consequence, much of the variation in diversity between sites was masked by the effects of crustacean swarms and it was therefore decided to use only species richness data in the analysis.

Results

A summary of the chemical analysis along with the site characteristics and number of taxa of plants and invertebrates is presented in Table 1. Full water chemistry results for these ponds were given by Slater *et al.* (1991).

Invertebrate taxa richness was found to be correlated with plant species richness but there was no correlation between plant richness and water beetle species richness (Table 2, Fig. 1). Both plant species richness and invertebrate taxa richness showed positive correlations with pH and conductivity. No such relationship was found for beetle species richness with these measurements of water chemistry (Table 2).

Splitting the data set on the basis of drying out of pools by September suggests that pools which dry out have a lower plant, beetle and general invertebrate richness than those which retain water (Table 3). A similar relationship between pond permanence and numbers of invertebrates has been identified by Banks and Beebee (1988).

Discussion

It has recently become common to write about the importance of conserving biodiversity (e.g. Wilson, 1992). Biodiversity is composed of a number of factors including species richness, rarity and habitat diversity. This paper is concerned with possible patterns in species richness. However, this is just one facet of biodiversity; for example, in some cases a site of very low richness may be of great conservation interest because of endemic or rare species (Hambler & Speight, 1995).

TABLE 1

Number of taxa of macroinvertebrates and macrophytes with physical and chemical data on the ponds.

Site	Grid. Reference	Altitude (m)	Presence of water in September 1987 W = wet D = dry	pH (Sept)	Conductivity at 20°C μsem⁻¹ (June)	Hardness* ration (June)	Plant Species	Invertebrate taxa	Beetle Species
Blackpool	SO 123 704	320	W	6.4	173	5.59	12	13	7
Aberedw Rocks	SO 084 459	324	W	5.5	65	0.59	19	10	2
Llanbadarn-y-Garreg	SO 125 483	480	W	5.7	59	1.68	16	9	3
Cradle Rocks (1)	SO 118 476	420	D	–	62	3.25	22	5	0
Cradle Rocks (2)	SO 117 477	420	W	5.4	40	1.25	5	8	6
Pant-y-Llyn (1)	SO 041 461	410	W	6.3	62	3.02	26	11	4
Pant-y-Llyn (2)	SO 039 467	410	W	6.4	55	2.23	11	4	0
Pentre Jack	SO 142 449	320	W	5.3	46	0.68	9	8	3
Park Farm	SO 159 719	300	W	6.8	175	5.21	31	14	0
Mawn Pool (1)	SO 160 511	490	W	4.7	94	0.98	3	6	2
Mawn Pool (2)	SO 160 513	490	W	4.5	61	0.31	3	8	5
Mawn Pool (3)	SO 132 487	440	W	4.4	65	0.36	8	4	0
Mere Pool (1)	SO 126 706	320	W	6.5	97	2.09	27	20	15
Mere Pool (2)	SO 130 709	320	W	6.6	53	1.24	23	19	–
Tireclyn	SO 081 453	200	D	–	60	1.24	11	12	1
Llanbedr Hill (1)	SO 144 483	420	D	–	48	0.34	4	5	1
Langodee	SO 145 485	420	D	–	42	0.58	5	2	1
Rhulen Hill	SO 127 483	440	W	4.8	54	0.75	11	5	5
Begwns (1)	SO 147 443	370	W	6.4	68	1.33	13	4	0
Begwns (2)	SO 149 444	370	W	6.1	82	0.15	7	6	2
Doctors Pool	SO 152 507	400	W	6.4	140	4.71	31	10	1
Beilibedw	SO 164 566	400	W	8.1	130	5.33	26	14	4
Llanneeh	SO 157 568	410	W	6.6	51	1.27	5	5	4
St. Teilo's Pool (1)	SO 093 456	330	W	5.8	50	0.89	11	8	1
St. Teilo's Pool (2)	SO 093 458	330	D	–	57	0.46	3	4	1
Llyn-y-Waun	SO 150 551	500	W	6.1	27	1.82	10	7	6
Aberdw Hill	SO 086 504	450	D	5.9+	–	–	20	9	0

*Hardness ratio is calculated as (Ca+Mg)/(Na+K), (Seddon, 1967).
+Aberedw Hill dried up in September between the collection of water for chemical analysis and being sampled for invertebrates.

TABLE 2

Matrix of Spearmans Rank Correlation coefficients between plant and invertebrate richness.

	Plant species	Invertebrate taxa	Beetle species
Invertebrate taxa	0.612**	–	–
Beetle species	-0.126	0.400*	–
pH	0.671**	0.464*	–.032
Conductivity	0.504**	0.417*	–0.117

* = P<0.05; ** = P<0.01

Note. Invertebrate taxa only counts the beetles at family level, this prevents the beetle identifications having a disproportionate effect on invertebrate richness and so allows beetle richness to be compared with general invertebrate richness.

TABLE 3

Effect of drying out of ponds in September. Mean ($\bar{x}$±SD) taxa richness found in June.

	Pond with water in September	Ponds dry in September
Plant species	14.6±9.2	10.8±8.4
Beetle species	3.5±3.5	0.7±0.5
Invertebrate taxa	9.2±4.6	6.3±2.9

Nature conservation often relies on the setting aside of reserves; this raises the question of how such areas are chosen and often choices have to be based on inadequate data. In the absence of full data so called 'quick-and-dirty criteria' for site selection are often used, such as ranking sites for species richness of well studied groups, 'higher' plants or birds, (good data for most invertebrate species usually absent) or using the presence of endangered species. As Kareiva (1993) pointed out, these 'processes could proceed remarkably well if concentrations of biodiversity for different taxa coincided'. The question is, do they?

If this relationship between species richness for different taxa occurs then it could be used to identify sites at a number of scales. Prendergast *et al.* (1993) have investigated such a relationship on the large scale, attempting to identify species-rich 'hot spots' for Britain using a grid of 10km x 10km squares. They found that species-rich areas often did not coincide for different taxa. The present study concentrates on the smaller scale, the selection of individual sites. Ponds provide an ideal habitat for such a study, being discrete units which are easy to sample.

As good plant species lists are usually more readily available than good invertebrate species lists, one can ask if ranking the ponds according to their plant species richness would result in also ranking the sites for invertebrate richness. The correlations shown in Table 2 suggest that, in this case, ranking using plant data would produce a reasonable ranking of general invertebrate richness but not of water beetle richness. Sites selected as reserves on the basis of their plant lists would therefore not necessarily make good water beetle reserves.

Both plant and general invertebrate richness correlates with water chemistry data, a result found in other studies of aquatic systems (e.g. Friday, 1987; Ormerod, 1987; Ormerod & Edwards, 1987). However, the water beetle results are again different, showing

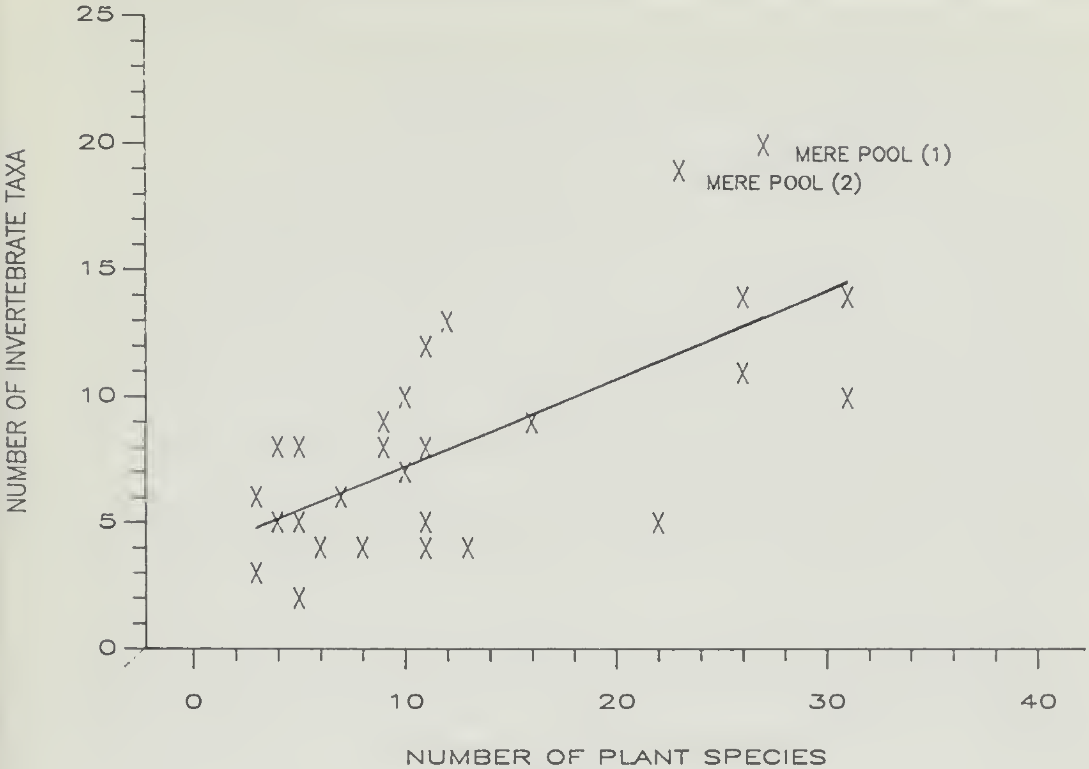

FIGURE 1

Relationship between number of plant species and invertebrate taxa. Regression line: NUMBER OF INVERTEBRATE TAXA = 0.353 (NUMBER OF PLANT SPECIES) + 3.69. The two Mere pools are about 800m apart, the fact that these two geographically related ponds behave in a similar manner suggests that the correlation has real biological significance and is not an artifact of the heterogenous level of taxonomic identification of the invertebrates.

no correlation with water chemistry. It is unclear from this study what factors are controlling water beetle species richness, except that seasonally dry ponds have a much reduced beetle fauna.

There is a need for more studies to investigate whether there is a strong correlation between species richness for different taxonomic groups and the relationship between species richness and the occurrence of rare species. Britain provides an ideal area to conduct such studies because of the wide range of highly competent amateur naturalists able to provide species lists for their local sites. Clearly, in the case of the mid Wales ponds, the relationship does not hold for water beetles. However, the extent to which one could generalise from ponds to other habitats (e.g. woodland) must be open to question. The breakdown of the relationship for Coleoptera, the most species rich Order known (May, 1992), is rather worrying.

Summary

Data from a set of ponds in the uplands of mid Wales (UK) are used to test the relationship between plant and invertebrate richness. This is of interest as a positive correlation between the two would suggest sites chosen for nature conservation on the basis of their plant lists are also good sites for invertebrates. A correlation between plant species richness and general invertebrate richness was found, but none between plant and water beetle species richness. While plant and general invertebrate richness was correlated with water chemistry (e.g. pH, conductivity) no such correlation was found for water beetle species richness.

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DROSOPHILA TESTACEA VON ROSER 1840 (DIPTERA: DROSOPHILIDAE), FIRST RECORD FOR YORKSHIRE AND NORTHERN BRITAIN

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INTRODUCTION

The ecology of *Drosophila* species is surprisingly little investigated compared to the intense study lavished on their genetics and molecular biology. The distributions of species are incompletely known, even in the comparatively well collected British Isles. Distributional information is particularly lacking for northern Britain despite Basden's (1954) collections in Scotland and 20 years of work in England near Leeds, Yorkshire (see Bingley & Shorrocks 1995, Davis & Jenkinson 1992 and references therein). We have therefore continued, as part of a Europe-wide investigation of *Drosophila* ecology, to collect in northern Britain and particularly in Yorkshire. We here report the discovery in Yorkshire of a *Drosophila* species previously known only from south-eastern England (BR Pitkin BM(NH) Drosophilidae database).

METHODS

Collections were made by baiting at two locations within each of three deciduous woods near Leeds, Yorkshire, England: Adel (Grid ref. SE273415, altitude 120m), Arthington (Grid ref. SE275450, altitude 55m) and Wike (Grid ref. SE332432, altitude 120m). These sites are described more fully elsewhere (Shorrocks 1975, Davis & Jenkinson 1992. Shorrocks & Charlesworth 1982). The baits, whole single mushrooms – *Agaricus bisporus* (mean fresh weight 11.26±2.18g) or pieces of cucumber – *Cucumis sativus* (36±4.3g), were exposed at monthly intervals between 1st March 1994 and 1st March 1995 with the exception of June 1994 and January 1995. The baits were set out in 4 x 3 arrays of the same type and one array of each type of bait was exposed at each location. The baits were retrieved after they had accumulated 250 day-degrees, maintained in an indoor insectary at approximately 20° and the emerging flies collected and identified. On 3rd August 1994 three *D. testacea* (Bächli 1990, Grimaldi *et al.* 1992), one female and two males, were recovered among flies from baits set out on 5 July 1994 at Arthington. All three *D. testacea* emerged from the same mushroom. This bait also yielded a single staphylinid beetle, 114 psycodid and three muscid Diptera. These taxa and *D. phalerata* emerged from the other mushroom baits exposed in Arthington at the same time.

DISCUSSION

This is the first record of *D. testacea* from Yorkshire and indeed from northern Britain. The species was previously known in the UK only from Kent and Suffolk in southern England (BR Pitkin BM(NH) Drosophilidae database, Bächli & Rocha Pité 1982) lending weight to Basden's (1956) opinion that *D. testacea* was a southern species. The species has, however, been recorded in northern Europe, in Norway, Sweden (Gahne 1959) and Finland (Hackman 1971) and is, in fact, widely distributed throughout Eurasia (Bächli & Rocha Pité 1982, Grimaldi *et al.* 1992). (Records of its occurrence in the Nearctic are now referred to a different species, *D neotestacea* (Grimaldi *et al* 1992).) There seems little evidence, therefore, for the belief that *D testacea* is not present in northern Britain so its apparent absence may well result from its rarity relative to other *Drosophila* species. We reared only three among the 32 individual *Drosophila*, all *D phalerata*, from mushrooms exposed on the same date or among the more than 1000 individual *Drosophila* reared from the 720 mushrooms exposed at all three sites during the entire 10 months of baiting. *Drosophila testacea* was not found at all during earlier long term studies at Adel (Bingley & Shorrocks 1995) and Wike (Shorrocks & Charlesworth 1982).

Drosophila testacea is also rare elsewhere in Europe. In the Netherlands it occurs sporadically (Hardy *pers. comm.*) and only 10 (misnamed as *D. picta*) were identified amongst 1683 *Drosophila* puparia from 120 *Phallus impudicus* in south Holland (Driessen *et al.* 1990). The species was also rare amongst flies from decaying herbage in Germany (Offenberger & Klarenberg 1992). In Switzerland, however, it is occasionally not rare at low altitudes but is always scarce higher in the mountains (Burla & Bächli 1991, Bächli *pers. comm.*). *Drosophila testacea* may therefore be less abundant in northern Europe and at high altitudes and might be considered a southern species for these reasons.

A contributory reason for the apparent rarity of *D. testacea* may be that the complete range of its breeding substrates has not been sampled. The species, with its relatives, are thought to be specialist fungal breeders (Bächli & Rocha Pité 1982, see also records listed in Grimaldi *et al.* 1992). However, in Switzerland it is most abundant in the spring and the summer which are not the main seasons for fungi (Bächli *pers. comm.*) It has also been reared from decaying herbage (Offenberger & Klarenberg 1992) and collected around carrion (Grimaldi *et al.* 1992). This suggests that the species might be encountered more frequently if microbial decays of non-fungal substrates were collected.

The addition of *D. testacea* brings the recorded *Drosophila* fauna of Yorkshire to 21 species (*D. andalusiaca*, *D. fenestrarum*, *D. immigrans*, *D. simulans*, *D. testacea*, and *D. virilis*, in addition to the 15 listed in Shorrocks 1975). This is nearly two-thirds of the 34 species known from the UK (Shorrocks 1972, Newbury *et al.* 1984, Bennet *et al.* 1995) but it is unlikely to represent the absolute total for Yorkshire. Our continued sampling will undoubtedly reveal more species as well as elucidate their biology and ecology.

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NOTES ON THE EMPIDOIDEA (DIPTERA) OF SOME LOWER SWALEDALE WOODS

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A series of ancient semi-natural woodlands extends for several miles upstream from Richmond in Swaledale, (VC65, North-west York), and these now form part of the Lower Swaledale Woods and Grasslands Site of Special Scientific Interest.

In 1992 and 1993 I undertook a survey of selected Diptera of the Hudswell Woods complex (NZ155006), which are owned by The National Trust, comprising Billy Bank Wood, Round Howe Wood, Calfhall Wood, Hudswell Bank Wood, and also the outlying Hag Wood (NZ136011). Additionally, in 1993 I surveyed High Spring Wood (NZ117000) and the contiguous Far Spring Wood, several miles further up the dale, which are owned by the Ministry of Defence.

All of these woods are on the steep north-facing side of the valley. Much of the Hudswell Woods complex borders the river, but Hag Wood only reaches the valley road which is some distance from the river at that point. High Spring Wood, which is wood pasture, is situated high up on the valley side and Far Spring Wood is on a steep scree-slope, extending down to the road.

The entomofauna of the woods is relatively unknown; Hudswell Woods have been surveyed in recent years by members of the National Trust Biological Survey Team; the findings have not been published and insects were not intensively surveyed during the visits. Some indication of the likely potential of the woods is indicated in the report prepared by W. A. Ely following the field meeting of the Yorkshire Naturalists' Union at Downholme in the near vicinity of High Spring/Far Spring Woods on 25 July 1987 (*The Naturalist* **113** (1988): 162).

This paper deals with flies of the superfamily Empidoidea, about which brief introductory notes are given in an earlier paper (Crossley, 1993).

In this study a total of 170 species of Empidoidea were recorded, comprising approximately 35% of the Yorkshire list. The numbers of species per family were as follows: Hybotidae 50; Microphoridae 1; Empididae 81; Dolichopodidae 38. Forty species

were found in all three woodlands (Hudswell Woods, Hag Wood and High Spring/Far Spring Woods), of which the largest number was Hybotidae with 38% of the total list being common to all. Figures for other families are: Empididae 16%; Dolichopodidae 21%.

Of the total number of species recorded, three are Red Data Book species and nineteen are Nationally Notable (Nb), as provisionally recommended in Falk, 1991. However, there are likely to be amendments to these provisional ratings (mostly down-gradings), in due course (Falk & Crossley, *in press*).

Thirty-nine species of Empidoidea were recorded for the first time in VC65 and the more significant of these are indicated with an asterix in the following list.

Nomenclature follows Kloet & Hincks (1976) with some up-dating.

**Platypalpus fasciatus* (Mg.) High Spring Wood 29.7.93. This is one of the larger *Platypalpus* species, some specimens measuring up to 4.5mm; it is also very distinctively marked on the abdomen with dust patches so it is not likely to have been overlooked in the past by competent dipterists. There are records for single localities in each of the five Yorkshire vice-counties, the earliest being Allerthorpe, 1931, and the remainder are all post-1980. It is probably a genuinely scarce fly in the county.

**P. macula* (Zett.) Nb. Hag Wood 2.7.92. There is only one other Yorkshire record for this distinctive species: Sleightholme Dale (VC62) 27.6.90, I. Perry.

P. nikii (Beck.) RDB3. Billy Bank Wood and Hag Wood 1992; High Spring Wood 23.6.93. Recorded from scattered sites throughout Yorkshire, this species appears to be associated mainly with ancient broadleaf woodland (Crossley, 1993). It was reported from White Scar Wood (near High Spring Wood), during the Y.N.U. visit to Downholme Park in 1987 (*op.cit.*)

P. subtilis (Coll.) RDB3. Billy Bank Wood and Calfhall Wood 27.7.92; Far Spring Wood 4.6.93. The main concentration of Yorkshire records for this species is along the River Wharfe from Otley to Collingham (VC64). Elsewhere in VC64 it is recorded from Hell Wath, Ripon, 1989 (R.C.). There are two reported sites in south Yorkshire and then a scattering of localities in VC65, and Duncombe Park, Helmsley (VC62). The majority of records are associated with river-banks or river-shingle, with overhanging tree-foliage upon which the adults presumably hunt for prey.

**Trichina bilobata* Coll. Billy Bank Wood 2.6.92; Calfhall Wood 27.7.92. In both woods specimens were found near the river-bank. The only other Yorkshire records for this species are Potter Brompton (VC61) 21.6.86, and Grass Woods (VC64) 16.6.88, both R.C.

**Rhamphomyia* (s.g. *Pararhamphomyia*) *albipennis* (Fall.) High Spring Wood, 19.5.93. There are several scattered records from all vice counties except VC62, with no apparent common habitat preference, and all of them post-1977.

R. (s.g. *P.*) *albitarsis* Coll. Nb. Round Howe Wood 28.5.93. There is a previous record for VC65, Rowton Beck 20.6.81, P. Skidmore, the species having first been noted in the county, also by Mr. Skidmore, at Ashberry (VC62) 8.6.80. There is a further record from Askham Bog (VC64) 14.5.88, R.C.

**R.* (s.g. *P.*) *atra* Mg. Billy Bank Wood 28.5.93. The only other Yorkshire records are from Towthorpe 26.5.90, W. A. Ely & R. C., and Burdale 23.5.92, A. Grayson, both localities being on the chalk of VC61.

R. (s.g. *P.*) *micropyga* Coll. Nb. High Spring/Far Spring Woods 19.5.93; Hag Wood 28.5.93. This spring species is recorded from about ten widely scattered localities in the north and west of the county with no reports so far from VC61 and VC63.

**R.* (s.g. *Rhamphomyia* s.s.) *nitidula* Zett. Nb. Round Howe Wood 28.5.93. For many years the only county record for this northern species was Gormire (VC62) 19.5.1923, C. A. Cheetham. In recent times there have been further records from a number of sites on the North York Moors: Ashberry, Dalby Forest, Newton Dale, Swair Dale.

**R.* (s.g. *R.* s.s.) *sulcatella* Coll. Round Howe Wood 8.5.93; High Spring Wood 19.5.93. This early spring species was first recorded in the county in 1992, since when it has been found in all vice-counties except 63 (Crossley, 1993).

R. (s.g. *R.*) *tibialis* Mg. Nb. High Spring/Far Spring Woods 19.5.93; Billy Bank Wood/Round Howe Wood 28.5.93. Apart from in isolated record in the south of VC63 (Rockley Dyke Marsh, 18.5.80, W.A.E.), all known sites for this spring species are in the Pennine areas of VC64 and VC65, together with a single locality at Bransdale on the North York Moors (VC62) and Duncombe Park, Helmsley (VC62).

**R.* (s.g. *Amydroneura*) *gibba* (Fall.) High Spring Wood 21.8.93. There is a cluster of records in the south-east of the county, and then scattered records elsewhere: Delph, Oldham (VC63) 4.8.85, R.C.; Timble Ings, Otley (VC64) 19.8.84, P.S.; Birk Crag Wood, Harrogate (VC64) 20.8.91, R.C.; Strensall Common (VC62) 11.8.93, R.C.

**Empis* (s.g. *Xanthempis*) *laetabilis* Coll. RDB3. High Spring Wood/Far Spring Wood 19.5. & 14.6.93. Other Yorkshire records for this species are: Pot Riding Wood (VC63) 30.5.88, W.A.E.; Grass Woods (VC64) 16.6.88, R.C.; Colt Park Wood (VC64) –.5/6.89, NCC malaise trap, det. R.C.

**E.* (s.g. *Empis* s.s.) *rufiventris* Mg. Nb. Hag Wood 11.6.92. This is a distinctive species, and although apparently very local in distribution it sometimes occurs in quantity; the dates suggest a restricted flight period and it may be overlooked on that account. Records relate chiefly to limestone woodland, as follows: Brockadale (near stream) (VC63) 2.6.56, K. G. Payne, same locality 14.5.88, W. A. E.; South Milford (VC63) 1988, P. J. Chandler; Pot Riding Wood (VC63) 24.5.92, A. Godfrey; Hetchell Wood (VC64) 11.6.88, R.C.& W.A.E. There is an older record for Pickering 6.6.38, C.A.C., *teste* F. W. Edwards, and a recent one for Duncombe Park, Helmsley, (both VC62) 17.5.94, R.C.

**Hilara albiventris* von Roser Nb. Billy Bank Wood 2.7.92. A single male specimen swept from overhanging tree-foliage by the river-side. Previously this species was known in Yorkshire only from scattered sites along the banks of the River Wharfe between Otley and Rougemont Wood, Weeton, from 1983 to 1987. A single specimen has also been found by the River Rye at Duncombe Park, Helmsley (VC62) 25.8.94, R.C. It is associated with fast-flowing rivers in other English localities.

**H. anglodanica* Lundb. Billy Bank Wood and Calfhall Wood 2.7.92; Round Howe Wood 7.6.93.This species was first reported in Yorkshire from Birkham Wood (VC64) 28.6.88 and 16.8.88. Since then it has been found at Sutton Wood and near Howden (VC61); and at Hayburn Wyke and Hutton Lowcross (VC62), all R.C.

**H. biseta* Coll. Nb. River-side, Billy Bank Wood 27.7.-25.8.92. The only other Yorkshire records for this late-summer species are from the banks of the River Wharfe at Otley (VC64) between 1983 and 1985, the dates of capture ranging from 1.8.-6.10., and the River Rye, Duncombe Park, Helmsley (VC62) 25.7.94, all R.C.

**H. discoidalis* Lundb. Nb. Billy Bank Wood 2.7.92; Calfhall Wood 27.7.92 (both localities near the river-side with overhanging tree-foliage). All known Yorkshire records, including these, are given in Crossley, 1993.

H. implicata Coll. Nb. River-side, Calfhall Wood 27.7.92. The only other Yorkshire records are Sandsend (VC62) 27.7.85 (on the shore); Semerwater (VC65) 20.& 23.8.88, all R.C.

H. morata Coll. Nb. River-side, Calfhall Wood 27.7.92. This species was recorded from three localities in Teesdale (VC65) in June 1981: Cotherstone, I. F. G. McLean, Scargill and Egglestone, P. J. C. In the same year it was recorded at Duncombe Park (VC62), P.S., and it has been reported from Hell Wath, and Birk Crag Wood (VC64) in 1989 and 1991 respectively, R.C.

**Chelifera concinnicauda* Coll. Nb. Hag Wood & Calfhall Wood 25.8.92. Reported so far from seven widely-scattered localities (two records being pre-1930), in all vice-counties except 61, known sites are on river-banks where there is overhanging tree-foliage on which the adults presumably hunt for their prey; the Hag Wood locality is an exception.

**Hemerodromia oratoria* (Fall.) Billy Bank Wood 2. & 27.7.92. There are only four known Yorkshire localities for this species, including this one, which are detailed in Crossley, 1993 .

Clinocera (s.g. *Hydrodromia*) *wesmaelii* (Macq.) Nb. High Spring Wood 28.6.93. Apart

from a single record from Dovedale Griff near Bridestones (VC62) 23.8.87, R.C., all Yorkshire records for this species are from Pennine localities of vice-counties 63, 64 and 65. There is a small cluster of sites in Upper Wharfedale where the species occurs typically on wet moss in the vicinity of waterfalls and swiftly flowing streams. The specimen at High Spring Wood was found at a muddy cattle-poached area close to the spring in the centre of the wood.

**Hypophyllus discipes* (Ahr.) Nb. Billy Bank Wood 2.7.92. There are only a few scattered localities known in Yorkshire for this species: Muston (VC61) (in a farmyard), 14.7.85, R.C.; Keld Head 31.8.84, G. King, and Harland Beck -.8.93, S. J. Falk (both VC62); Crag Wood 29.6.25, C.A.C., and Ripon 17.6.39, possibly C.A.C. (both VC64).

**Campsicnemus marginatus* Lw. Nb. River-side at Billy Bank Wood 27.7.92. This species is typically found along the banks of fast-flowing rivers and there were several records in the 1980's from the River Wharfe between Otley and Collingham (VC64), R.C. & I.P. There are also records from the River Rye at Rievaulx 23.7.85, P. Withers, and at Duncombe Park 12.10.90, R.C., and the stream in Mulgrave Woods 15.9.90, R.C. (all VC62). The only atypical site so far recorded is the flooded gravel pits at Hay-a-Park, Knaresborough (VC64) 1991, R.C.

Further Nationally Notable species recorded, but not commented upon are: *Platypalpus cothurnatus* Macq., *P. tonsus* (Coll.) and *Sympycnus spiculatus* Gerst.

Additional vice-county records are: *Platypalpus leucocephalus* (von Roser); *P. optivus* (Coll.); *Oedalea flavipes* Zett.; *O. zetterstedti* Coll. Nb.; *Rhamphomyia* (s.g. *Megacyttarus*) *anomalipennis* Mg.; *R.* (s.g. *Amydroneura*) *hirsutipes* Coll.; *Empis* (s.g. *Xanthempis*) *scutellata* Curt.; *E.* (s.g. *Coptophlebia*) *albinervis* Mg.; *Hilara cornicula* Lw.; *H. galactoptera* Strobl; *H. lurida* (Fall.); *H. nigrina* (Fall.); *H. subpollinosa* Coll.; *Dolichocephala engeli* Vaillant in litt.; *Medetera impigra* Coll.; *M. jacula* (Fall.); *M. truncorum* Mg.; *Syntormon denticulatus* (Zett.); *Neurigona pallida* (Fall.); *Teuchophorus calcaratus*(Macq.); *T. spinigerellus* (Zett.).

Discussion

The results of this survey give some indication of the rich diversity of the empidoid fauna of the combined woodland sites and adjoining river-banks, and in particular the significantly high proportion of scarce species.

Applying the Species Quality Index (Crossley, in press) to the results places these woods quite clearly within the upper ranking of such habitats in Yorkshire. Indeed Hag Wood with an Index of 4.0 produced the highest S.Q.I. so far obtained in a continuing study which now covers sixteen woods, the average Index for these being 2.50.

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HEDGEROW ECOLOGY AND THE LANDSCAPE HISTORIAN

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The field of ecology offers many opportunities for co-operation between naturalists and landscape historians, particularly in England where landscapes are largely man-made. This is certainly true of hedgerows. If, as many wrongly believe, extensive hedgerow networks have only existed in England since Anglo-Saxon times then our elaborate hedgerow ecological systems can only be the products of a thousand or so years of indigenous evolution. However, if the landscape archaeologist can demonstrate that such networks have existed for over five thousand years then their ecology requires reinterpretation. Misconceptions about hedgerows abound; this paper attempts to outline a more reliable historical context for studies of their ecology.

When Hoskins (1955) wrote his celebrated *Making of the English Landscape*, it seemed safe to assume that the founding fathers of our countryside were the Anglo-Saxon pioneers who settled here from the fifth century onwards. Now, however, we realise that the England of the Bronze Age and Iron Age was densely stippled with farmsteads, and that the outlines of much of the English countryside were established during the Neolithic period, almost seven thousand years ago.

Archaeological traces of hedgerows are not easily located and dated, but over recent years a variety of evidence has emerged. The first historical description of hedgerows in north-western Europe was provided by Julius Caesar in his account of events in the Roman battle for Gaul in 57 BC. He told how the Nervii, who lived in the region that now forms the Franco-Belgian borderlands, had ". . . succeeded in making hedges that were almost like walls, by cutting into saplings, bending them over, and intertwining thorns and brambles among the dense side branches that grew out". Although Caesar was impressed by the robust impenetrability of the hedges of the Nervii, hedging was well known to ancient Romans, and treatises or comments on the craft were variously provided by Cato, Columella, Palladius Rutilius, Pliny, Scrota and Varo.

The existence of hedges in Roman Britain is testified both by excavation and by landscape evidence. About a decade ago, the Roman fort at Bar Hill on the Antonine Wall in southern Scotland was excavated. The archaeologists found that, when constructing the fort around AD 142, the builders were obliged to in-fill some existing ditches, using turves and bundles of hawthorn (*Crataegus monogyna*) brushwood cut from a managed hedgerow nearby. Williamson (1987) was also able to show that since a Roman road, known as the Pye Road, cut diagonally across a network of hedged fields in the vicinity of Yaxley in Suffolk, the road had to be later than the fields it crossed. These fields, part of an extensive network still largely intact when mapped in 1839, may have been produced by a systematic reorganisation of the East Anglian countryside during the Iron Age, creating extensive systems of hedged fields now recognised as spanning expanses of countryside between 10 and 35 km^2 in area.

Some evidence of prehistoric hedgerows has come from Yorkshire. The West Heslerton project is a programme concerned with the landscape archaeology of the Yorkshire Wolds. Iron Age field ditches have been revealed, and Powlesland (1986) has provided faunal evidence: remains of snails known to be associated with wood and hedgerow environments have been found along just one side of a ditch, implying that on this side of the field ditch there ran a hedgerow. On the North York Moors, evidence from sites like Iron Howe suggests that hedgerows formed the field boundaries during the Bronze Age, when these upland countrysides were more densely populated than in later times. Lee (*pers. comm.*) has suggested that the linear patterns of stone litter observed here may represent stones cleared from cultivated ground and tossed into the bottoms of adjacent hedges.

Perhaps the most impressive information on prehistoric field patterns has come from Dartmoor, where it was realised that the tumbledown walls or 'reaves' which criss-cross the moor trace out a comprehensive division of the countryside dating from the Bronze Age, around 1600 BC. Fleming (1985) believes that these earth and boulder banks could have carried hedges, in the manner of hedgebanks seen today in North Wales.

Bronze Age England was far from being a natural wilderness. Marshes remained, but woodland had been, or was being, removed from virtually all areas which had a reasonable agriculural potential. In some places planned field systems, created by a single decision, sharing a common orientation and covering thousands of hectares, stretched as far as the eye could see. All such fields had to be bounded, and in most places, hedgerows will have offered the most practical method.

The hedgerow mileage fluctuated over time. During the Roman occupation, the stimulus of access to imperial markets and the imposition of peace caused farming to expand, resulting in the establishment of new systems of hedged fields, like the rectilinear field network on the Dengie Peninsula in Essex, with hedges now thoroughly invaded by elm (*Ulmus procera*).

Disease, decay and the contraction of farming characterised the early centuries of the Anglo-Saxon settlement in England, but after the 8th century the adoption of open field farming must have resulted in the grubbing-up of countless hedgerows to create the uninterrupted expanses of ploughland associated with this communal form of cultivation. In the early Middle Ages, sustained population growth and the associated shortages of farmland resulted in thousands of small, irregular fields, known as 'assarts', being cleared from the retreating woodland. Then, in the late Middle Ages, the piecemeal enclosure and 'privatisation' of open field land by villagers created a multitude of new hedgerows.

Quite different from these products of what the landscape historians term 'early enclosure' were the hedgerows created by Parliamentary Enclosure. This was England's first and most traumatic experience of privatisation and, in the parishes affected, it involved the enclosure, partitioning and transfer into single ownership of the common ploughland, meadow and pasture. In each case, it was required that the new allocation of straight-edged and privately owned fields should be hedged (or, in the stone-rich areas, walled) within a year of the enclosure award being made. According to Gonner (1966), one fifth of the area of England was directly affected, while Parliamentary Enclosure resulted in the planting of over a billion shrubs and the establishment of around 200,000 miles (321,870 km) of new hedgerows. During the period 1750-1850 when the movement was at its height, hedges must have been planted at an average rate of 2,000 miles (3,220 km) each year. Designed by surveyors and superimposed upon the landscape from their maps, the angular geometry of Enclosure hedgerows provides a distinctive tracery across many English countrysides. In terms of the size of the areas affected by Parliamentary Enclosure, West Yorkshire and East Yorkshire ranked second and fifth amongst the 'counties' of England and Wales.

These Parliamentary Enclosure hedgerows differed from those created in the earlier centuries in ways that were ecological as well as historical. Whereas the older hedgerows seem generally to have been planted with mixed saplings gathered from local woods – often deliberately including useful timber and/or fruiting species, like oak (*Quercus robur*), hazel (*Corylus avellana*) and crab apple (*Malus sylvestris*), the new hedgerows were usually monocultures of nursery-grown hawthorn. Harvey (1974) has described the early days of the nurseryman in England, and we know that in 1766 a Berkshire nurseryman sold 4,000 hawthorn 'quicksets' for hedging to Lord Bruce of Tottenham for the sum of 5s (25p).

Just as the planting of 80 many miles of hedgerow in the 18th and 19th centuries must have contributed profoundly to the bird and insect populations, so the modern wave of destruction has been disastrous. During the postwar period, hedges have been removed at a rate far faster than that at which they were planted during the heyday of Parliamentary Enclosure. In a study on 'Monitoring Landscape Change', the Countryside Commission (1986) and Hunting Technical Services estimated that during the period 1947-85 the absolute length of hedgerows in England and Wales was reduced by about 190,000 miles (around 300,000 km) or 22%.

Ecologists concerned with the study of hedgerow flora and fauna would be well advised to consider the historical aspects of the hedge concerned. Historical factors are bound to have influenced the tree and shrub composition of the hedge, its form (whether straight or curving) and its management (concerning factors like the frequency of laying and whether it was managed to provide a barrier to small lambs or powerful bullocks). Parliamentary Enclosure hedgerows were normally planted as a hawthorn monoculture and now also contain those other shrub species which can rapidly colonise a hedgerow: elder (*Sambucus nigra*); ash (*Fraxinus excelsior*); wild rose (*Rosa* agg.) and bramble (*Rubus* agg.), and sycamore (*Acer pseudoplatanus*). In contrast, shrubs like hazel, oak, field maple (*Acer campestre*), crab apple and *Prunus* agg. will seldom if ever be found as colonists in a young hedge.

The many historical aspects of hedgerow ecology are well-represented in Yorkshire. Here, the enclosers of land have had their choices strongly influenced by environmental factors. On the lower ground, where the bedrock is soft or masked by glacial till or alluvium, hawthorn and other hedging shrubs flourish, while in the uplands, where the soils are too thin and the climates too harsh for vigorous shrub growth, tough gritstone and limestone for walling can easily be quarried or gathered from the screes or surface stone litter. However, the Archaeological Survey of West Yorkshire (1981) notes that over the Coal Measures and gritstone areas of the county, walls have succeeded earlier hedgerows: "[Boundaries] in the Pennines are now mostly of stone, implying that a large-scale change took place sometime after 1340 in the manor of Wakefield and 1363 in the manor of Bradford, the dates after which the respective rolls have not been exhaustively searched. The term invariably used to describe field boundaries in medieval West Yorkshire is the Latin *sepes*, which can mean a hedge, fence or wall, but there is evidence to suggest that its use in medieval West Yorkshire was restricted to a hedge . . . It seems possible that the major change from hedge to stone boundary in the Pennines took place during the seventeenth and eighteenth centuries when the medieval fields were enclosed and greatly extended to include extensive new areas for agricultural use".

Place-names like 'Haya', 'Haye' and 'Haigh', which derive from the Anglo-Saxon term for a hedge, are quite numerous, while there are plentiful documentary references to the management of hedges in medieval Yorkshire. More numerous than the Haya and Haye names are those including 'Royd' or 'Rode', which denote assarts cleared during the Middle Ages (mainly before the arrival of the Black Death in 1348) to create new farmland. The fields in such assarted Yorkshire land were generally hedged, and the records of the Wakefield manor court for 1316 tell how one John son of Beatrice was fined 2s (10p) for removing the hedge of an assart on the lord's land. The use of thorny species for hedging is often mentioned in this period, and in 1338 the leaseholder of new arable land at Birstall was given permission to take from woods nearby the branches, brambles and thorns needed to enclose it with hedges. Sometimes hedge barriers defined unpopular enclosures into private ownership of land that was previously held in common, and the manor courts periodically sought to fine the destroyers of such hedges, as with the case above, or as at Oxenhope in 1346. People were also fined at the manor courts for failing to enclose their fields with hedges, and so allowing hungry livestock to wander and feed at will. Thus it is clear that the manorial courts of Yorkshire required, or at least encouraged, the hedging of land newly taken into private ownership or tenancy; they sometimes allowed hedging plants and materials to be taken from the lord's woods nearby, and they would fine the breakers of hedges quite substantial sums.

Hedgerows are features of the man-made landscape which more or less replicate open woodland and woodland edge environments. Arnold (1983) has described how different hedgerow types favour different forms of wildlife. Song thrushes and blackbirds choose to nest at heights *c.* 1m above ground level, and they select dense, bushy hedges at least 1.4m tall. Partridge, in contrast, nest in the verges of more open hedgerows which will not impair their ability to scuttle to and from the nest. The importance of hedgerows to just this one bird species was underlined by Blank (1961), who found that in North Norfolk only

2% of partridge nests discovered were not in hedgerows. It must be accepted that many of the plant and animal species which hedgerows harbour are both common and tolerant of stressful, open environments. At the same time, most older hedges are punctuated by trees which have been allowed to grow tall as 'standards' and their presence adds an extra ecological dimension to the hedgerow environment. Moreover, hedgerow shrubs serve as hosts to a wide variety of insects which play an important role in food chains, while hedgerows also perform useful roles as windbreaks, offering shelter and protection against erosion of soil exposed in arable fields. Finally, their significance to the spiritual, emotional and aesthetic dimensions of the English consciousness is profound, though impossible to quantify.

Hedgerows of different kinds may well have existed in England for over six thousand years, and during this time many hedge-dependent associations of plants and animals have developed. Currently, the creative aspects of the human relationship with the environment are darkly overshadowed by our destructive activities, so that it is particularly heartening to find so many young people devoting their weekends to voluntary work in planting or laying hedgerows. A better understanding of the antiquity and evolutionary characteristics of the English hedgerow network may assist future projects in Nature conservation.

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BOTANICAL REPORT FOR 1994
FLOWERING PLANTS AND FERNS

Compiled by D. R. GRANT

The Recorders thank all those who have sent in records: their names are given in full the first time they appear in the VC report, initials being used thereafter. Nomenclature is according to Kent, D. H. (1992) *List of Vascular Plants of the British Isles.*

EAST YORKSHIRE (VC61) (F. E. Crackles)

An interesting discovery is that maritime species occur on salted roadsides in VC61, notably that *Puccinellia distans* is widely distributed on both "A" and minor roads and that *Cochlearia danica* occurs on Clive Sullivan Way and on the M62.

An asterisk denotes a new vice-county record.

Polystichum setiferum (Forsskal) Moore ex Woynar Moat, Leconfield 54/04; J. Dews.

Artiplex littoralis L. On verge of Weghill Rd., and B1362 near Burstwick 54/22, on roadside near Hollym and near Dimlington 54/32; P. J. Cook, roadside near Escrick 44/64; K. G. Payne.

Cerastium diffusum Pers. Coastal sand, Hornsea 54/24; P.J.C.

C. semidecandrum L. Disused Rly near Withernsea 54/32; P.J.C.

Spergula marina (L.) Griseb. Roadside between Roos and Burton Pidsea 54/23; W. Dolling. By B1362 near Burstwick 54/22, near Hollym 54/32, verge near Preston 54/13; P.J.C.

Cochlearia danica L. By Clive Sullivan Way near Hessle 54/02, near Ferriby 44/92 and in an almost continuous ribbon on the eastbound carriageway of the M62 from just west of Howden to Saltmarshe Grange 44/72; P.J.C.

Saxifraga tridactylites L. Haverfield Pits 54/31; P.J.C.

Rubus scissus W. C. R. Watson. Sutton Wood 44/74; D. R. Grant.

R. nemoralis P. J. Mueller. Newport 44/82, Allerthorpe Common 44/74; D.R.G.

R. polyanthemus Lindeb. Allerthorpe Common 44/74; D.R.G.

R. ulmifolius Schott Kilnsea Beacon Lane 54/41, roadside north of Wheldrake 44/64; D.R.G.

R. echinatoides (Rogers) Dallman. Sutton Wood 44/74; D.R.G.

R. hylocharis W. C. R. Watson. Allerthorpe Common 44/74; D.R.G.

Rubus eboracensis W. C. R. Watson. Allerthorpe Common 44/74; D.R.G.

R. Warrenii Sudre King. Rudding Lane, Riccal 44/63; D.R.G.

Oenothera biennis L. Near Roos 54/23, in 1993; P.J.C.

Myosotis ramosissima Roche. Haverfield Pits 54/31, in 1993; W.D.

Lamiastrum galeobdolon (L.) Ehrend. & Polatschek Under trees by the R. Derwent, near Stamford Bridge 44/75; A. J. Horne.

Linaria vulgaris x *L. repens* = *L.* x *sepium* Allman. King George Dock, Hull 54/12; R. Eades.

**Valerianella carinata* Lois. On an old wall, disused Rly Stn, Keyingham 54/22, in 1993; W.D., conf. A. O. Chater.

Lactuca serriola L. Hollym Carrs 54/32, in 1993, P.J.C., near Danthorpe 54/23 in 1993; W.D.

Hieracium vagum Jordan. Allerthorpe Common 44/74, Flowering Plant Section field meeting.

Aster tripolium L. Roadside verge, Hedon bypass 54/12; P.J.C.

Conyza canadensis (L.) Cronq. Pavement, Withernsea, arable, Hollym 54/32, Keyingham Mill 54/22, in 1993; P.J.C.

Potamogeton berchtoldii Fieber. Ponds near Hollym, 54/32, and near Skirlaugh 54/13; P.J.C.

Lemna gibba L. Market Weighton Canal, near Broomfleet 44/82; D.R.G.

Eriophorum latifolium Hoppe. Speeton 54/17, 1993; D. Leach.

Festuca rubra L. subsp. *juncea* (Hackel) K. Richter. Humber Bank, near Easington 54/31; P.J.C.

Puccinellia distans (Jacq.) Parl. By the side of the M62 near Howden 44/72; D.R.G. and here and there by the A63 and Clive Sullivan Way 44/92 and 54/02; P.J.C. Widely distributed along verges both of "A" and minor roads in S. Holderness, often occurring continuously for some distance along the edge of the verge where salt has been used; being recorded for roads in 10km. squares 54/12, 13, 22, 23, 31, 32 and 33; P.J.C. It has been recorded for scattered localities along roads near Driffield 54/05; Beeford and Atwick 54/15; P.J.C.

Glyceria fluitans x *G. notata* = *G. pedicellata* F. Towns. Spring fed marsh, near Skirlaugh 54/13; P.J.C., conf. F. E. Cracles.

Melica uniflora Retz. Nursery belt, Swine 54/13; F. Kenington, confirming an old record (Robinson's *Flora*, 1902).

Allium vineale L. Roadside verge, near Aldborough 54/23, 1993; W.D.

Ruscus aculeatus L. Near Roos 54/22, 1993; P.J.C.

NORTH-EAST YORKSHIRE (VC62) (T. F. Medd)

Asplenium trichomanes L. Car park, York 44/65; M. Hammond.

Cystopteris fragilis (L.) Bernh. Same car park and also near Museum gardens, York 44/55; M.H.

Ranunculus trichophyllus Chaix. Clifton Ings, York 44/55; M.H.

Humulus lupulus L. By river Foss, Strensall 44/66; YNU FWBS Excn.

Chenopodium polyspermum L. Clifton Moor, York 44/55; T.F.M.

Atriplex littoralis L. Haxby roundabout, York ring-road 44/65; P. Cook.

Polygonum arenastrum Boreau. Bootham Crescent, York 44/55; T.F.M.

Hypericum x desetangsii Lamotte. Layerthorpe, York 44/65; M.H.

Sisymbrium orientale L. Yarm 45/41; Dr S. Bungard.

Rubus scissus Watson. Strensall 44/66; YNU FWBS Excn. and Allerston Forest 44/98; D.G.

R. vestitus Weihe. Saltergate 44/89; YNU Bot.Sec.Excn. det. D.G.

R. sprengelii Weihe. Strensall (YWT Reserve) 44/66; YNU FWBS Excn. det. D.G.

R. echinatoides (Rogers) Dallman. Kingthorpe 44/88; D.G.

R. eboracensis Watson. Strensall (YWT Reserve) 44/66; YNU FWBS Excn. and Allerston Forest 44/98 det. D.G.

R. warrenii Sudre. Strensall (YWT Reserve) 44/66; YNU FWBS Excn. det. D.G.

Potentilla x mixta Nolte ex Reichb. Clifton Backies 44/55; M.H.

Vicia sylvatica L. Moorsholme 45/71; S.B.

Pinguicula vulgaris L. Yearsley Moor 44/57; T.F.M.

Pulicaria dysenterica (L.) Bernh. Allerston Forest 44/98; D.G.

Bidens tripartita L. Bootham Stray, York 44/65; M.H.

Eupatorium cannabinum L. By river Foss, Strensall 44/66; YNU FWBS Excn.

Alisma lanceolatum With. Rawcliffe Ings, York 44/55; M.H.

Potamogeton polygonifolius Pourret. Strensall Common 44/66; YNU FWBS Excn.

P. pusillus L. Rawcliffe Ings, York 44/55; M.H.

P. pectinatus L. R. Foss, Strensall 44/66; YNU FWBS Excn.

Juncus subnodulosus Schrank. Saltergate Moor 44/89; YNU Bot.Sec. Excn.

Isolepis setacea (L.) R. Br. Yearsley Moor 44/57; T.F.M.

Carex echinata Murray. Overton 44/55; M.H.

C. vesicaria L. Pond Head, Brandsby 44/57; M.H.

SOUTH-WEST YORKSHIRE (VC63) (D. R. Grant)

Ophioglossum vulgatum L. Near Mytholmroyd 34/92; L. Lloyd-Evans. Todmorden 34/92; G. Barker.

Pilularia globulifera L. Near Dinnington 44/58; J. Nebould.
Ceratophyllum demersum L. Old canal Hemingfield 44/40; T. Schofield.
Rumex longifolius D.C. Marsden Gate, Stainland 44/10; F. Murgatroyd.
Ceratocapnos claviculata (L.) Liden Mount Pleasant, Rossington 43/69; E. Thompson.
Viola canina L. Potteric Carr Nature Reserve, Doncaster 44/60; D. Bramley.
Populus tremula L. Haywood, near Doncaster 44/51; E.T.
Teesdalia nudicaulis (L.) R. Br. Austerfield 43/69; T. Higginbotham.
Samolus valerandi L. Askern 44/51; I. Macdonald.
Rubus rufescens Lef & P. J. Mueller. Silkstone Common 44/20; D. R. Grant.
Rubus tuberculatus Bab. Fostcrhouses, Fishlake 44/61; D.R.G.
Rubus warrenii Sudre. Hampole 44/51; D.R.G., Middlestown, Wakefield 44/21; E.T.
Rubus scissus W. C. R. Watson. Hoyle Mill Country Park, Barnsley 44/30; T.S., Eastwood, Todmorden 34/92; D.R.G., Langsett 44/10; D.R.G., Denholme Clough 44/03; T.S.
Rubus nemoralis P. J. Mueller. Gowdall 44/62; T.S., Sutton, Kly. 44/04 T.S.
Rubus sprengelii Wcihe. Denholme Clough 44/03; T.S.
Rubus ulmifolius Schott .Whitley Head, Steeton 44/04; D.R.G., Rawcliffc 44/62; E.T.
Rubus newbouldii Bab. Ryecroft Glen, Sheffield 43/38; D.R.G., Mount Pleasant, Rossington 43/69; D.R.G.
Rubus echinatoides (Rogers) Dallman. Fishlakc 44/61; E.T., Gunthwaite 44/20; Shibden Valley 44/02; T.S.
Rubus echinatus Lindley. Newmillerdam, Wakefield 44/31; D.R.G., Austerfield 43/69; E.T.
Rosa mollis Smith. East Marton 34/95; D.R.G., Lothersdale 34/94; E.T.
Genista anglica L. Scout Dike Resr, Penistone 44/20; Y.N.U. Excn.
Foeniculum vulgare Miller. Hemingfield 44/40; E.T.
Callitriche hamulata Kuetz ex Koch. Scout Dike Resr, Penistone 44/20; Y.N.U. Excn.
Littorella uniflora (L.) Asch. Scout Dike Resr, Penistone 44/20: Y.N.U. Excn. Ardsley Resr, Wakefield 44/22; D.R.G.
Verbascum nigrum L. Mirfield 44/21; J. Greaves.
Veronica filiformis Smith. Austerfield 43/69; T.S.
Galium mollugo L. Gowdall 44/62; E.T.
Pulicaria dysenterica (L.) Bernh. Lothersdale 34/94; E.T.
Juncus subnodulosus Schrank. Askern 44/51; I. MacD.
Carex paniculata L. Rivelin Resr, Sheffield 43/28; D.R.G.
Carex laevigata Smith. Brockholes Spring, Penistone 44/20; L. L-E.
Festuca altissima All. Stannally Clough, Todmorden 34/93; F.M.
Alopecurus myosuroides Hudson. Near Fishlake 44/61; E.T.
Hordeum secalinum Schreber Near Fishlake 44/61; D.R.G.
Narthecium ossifragum (L.) Hudson. Brockholes Spring, Penistone 44/20; L. L-E.
Nitella flexilis (L.) Agardh. Pond near Scout Dike Resr, Penistone 44/20; L. Magee.
Chara globularis Thuill. New scrape, Potteric Carr Nature Reserve. Doncaster 44/60; Y.N.U. Excn.

MID-WEST YORKSHIRE (VC64) (L. Magee)

A large number of reports were received from recording groups and from individuals. Considerable road construction, involving diversions of roads and rivers, quarrying, transport of ballast and heavy equipment, is in progress in the county. This has created new habitats which have been quickly colonised by plants, some of these were species which were previously very local and some are adventive. Investigation of these new sites has proved to be rewarding; another source of new records is from 'set aside' farm land. Some important records have been received without national grid references; these will be included in future reports when verified. The recorder thanks all who have sent records and regrets that it is not possible to include more than selection in this report.

Pilularia globulifera L. Lumley Moor Reservoir, near Grantley 44/2270: E. Thompson.
Asplenium trichomanes-ramosum L. Threshfield Moor 34/9662, 1992; H. LeFevre.
Blechnum spicant (L.) Roth. Threshfield Moor 34/9662, 1992; H.L.
Nuphar lutea (L.) Smith. Hollins Hall Pond, Harewood, introduced 44/34; L. Magee.
Helleborus foetidus L. Boston Spa 44/4345; D. Grant and T. Schofield; Grass Woods 34/96; Grassington Naturalists per R. Kydd.
Ranunculus hederaceus L. Lower Barden Reservoir, 44/05; L.M.
R. hederaceus L. Threshfield Moor 34/9662, 1992; H.L.
R. aquatilis L. Mucky Pond, Brearey Lane, Bramhope 44/24; L.M.
R. penicillatus (Dumort) Bab. subsp. penicillatus Inlet. Barden Reservoir 44/05; YNU Excursion per L.M.
Chelidonium majus L. Warren Lane, Arthington. Hundreds of plants 44/24; L.M.
Atriplex littoralis L. Outer Ring Road, York 44/54; M. Hammond.
Minuartia hybrida (Villars) Schischkin. Fountains Abbey 44/26; Harrogate Naturalists' Society.
Myosoton aquaticum (L.) Moench. Birkin 44/5226; P. P. Abbott.
Persicaria bistorta (L.) Samp. Woodside, Horsforth 44/23 abundant; L.M.
Samolus valerandi L. Staveley Reserve 44/3663, 1991; per J. J. Evison.
Cochlearia danica L. Outer Ring Road, York 44/54; M.H.
Rubus scissus W. C. R. Watson. Near Riddlesden 44/0544; D.G. and T.S.
R. warrenii Sudre. Grewelthorpe 44/2376; D.G. and T.S.
Euonymus europaeus L. Grass woods 34/96; R. Kydd.
Menyanthes trifoliata (L.) Little Ouseburn 44/4460; P.P.A.
Smyrnium olusatrum L. Near Bishop Monkton 44/320617; M. Sanderson per J.J.E.
Scutellaria minor Hudson. Adel Bog 44/2839. Confirmation of old record; D.G. and T.S.
Scrophularia umbrosa Dumort. Haw Bank Quarry, Skipton 34/95; R.K.
Littorella uniflora (L.) Asch. Lumley Moor Reservoir, near Grantley 44/2270; D.G. and T.S.
Senecio fluviatilis Wallr. Riverside, Bolton Abbey 44/0755; D.G. and T.S.
Baldellia ranunculoides (L.) Parl. Staveley Reserve, 'adventive' 44/3663; J.J.E.
Zannichellia palustris L. Staveley Reserve 44/3662; per J.J.E.
Cladium mariscus (L.) Pohl. Little Ouseburn 44/4460; P.P.A.
Juncus subnodulosus Schrank. Staveley Reserve, 44/3663. 1991; J.J.E.
Carex paniculata L. Acomb Grange, York 44/55; M.H.
C. spicata Hudson. Nunnery Lane, York 44/55; M.H.
C. pendula Hudson. Near Riddlesden 44/0544; D.G. and T.S.; Meanwood Valley 44/2737; D.G. and T.S.
C. strigosa Hudson. Airton 34/9058; Bilton-in-Ainsty 44/4648; P.P.A.
Apera spica-venti (L.) P. Beauv. Burn, Temple Hirst 44/6026; P.P.A.
Hordeum secalinum Schreber, Nether Poppleton 44/5454; P.P.A.
Epipactis atrorubens (Hoffm.) Besser. Pen-y-ghent 34/8272; P.P.A.
Ophrys apifera Hudson Haw Bank Quarry, Skipton, 34/95; R.K.

NORTH-WEST YORKSHIRE (VC65) (T. F. Medd)

Cochlearia danica L. Roadside, A1 44/28; 44/29; 44/38; 45/20; S.B.
Rubus lindleianus Lees. Roomer Common, Masham 44/27; D.G.
R. nemoralis Mueller. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.G.
R. ulmifolius Schott. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.G.
R. vestitus Weihe. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.G.
R. echinatoides (Rogers) Dallman. Roomer Common, Masham 44/27; D.G.
R. eboracensis Watson. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.G.
R. tuberculatus Bab. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.G.
R. warrenii Sudre. Roomer Common, Masham 44/27; D.G. and Aysgarth 44/08; YNU Bot.

Sec. Excn. det. D.G.

Verbascum thapsus x nigrum = V. x semialbum Chaub. Banks of R. Ure, Leyburn 44/08; F. M. I. Paterson per J. Lambert det. Dr I. K. Ferguson – New VC record.

Veronica catenata Pennell. Melmerby 44/37; Dr A. D. Martin.

Juncus compresus Jacq. Dent station 34/78; Dr O. L. Gilbert.

CASUALS AND ADVENTIVES (E. Chicken)

Since the 1993 report, 61 records have been received from 10 individuals for 47 taxa. In addition, two records of roses planted for landscaping purposes were received from Dr L. Lloyd-Evans. These are not included in the figures given, but the information is useful and has been incorporated in the card index. As usual, the greatest number of taxa came from Mr John Martin working the shoddy treated fields near Wakefield. There is a renewed interest in alien species and this area was visited by a party from the Botanical Society of the British Isles. The greatest number of records for one species was six for *Rubus procerus* reflecting a current interest in the Brambles.

The contributor is assumed to be the determiner unless otherwise stated.

Soleirolia soleirolii (Req.) Dandy (62) Beckside near Allerston 44/88; P. J. Cook.

Lavatera cretica L. (63) Brandy Carr Farm, Wakefield 44/32; J. Martin 1993.

Hibiscus trionum L. (61) Urban garden, Withernsea 54/32; P.J.C.

Malcolmia maritima (L.) R. Br. (64) By Carriage Works, York 44/55; Miss J. Lambert det. E. Chicken.

Gaultheria mucronata (L.f.) Hook. & Arn. (63) Elland Park Woods 44/12; T. Schofield per D. R. Grant.

Tellima grandiflora (Pursh) Douglas ex Lindley (63) By woodland path, Meltham 44/11; Mrs J. Lucas.

Rubus cockburnianus Hemsley (63) Newmillerdam near Wakefield 44/31; D.R.G.

Rosa multiflora Thunb. ex Murray (63) Near Silkstone Church, near Barnsley 44/20; T.S. per D.R.G.

Rosa x *alba* L. (61) Roadside hedge, Foxholes 54/70; E.C. det. Dr R. Melville 1975, previously reported and thought to have been lost.

Galega officinalis L. (63) Wrenthorpe near Wakefield 44/32; D. Procter per D.R.G.

Coronilla scorpioides (L.) Koch (63) Brandy Carr Farm, Wakefield 44/32; J.M. 1993.

Securigera varia (L.) Lassen (63) Derelict land at Longwood, Huddersfield 44/11; C. Yeates 1993 per Mrs J.L.

Melilotus sulcata Desf. (63) Brandy Carr Farm, Wakefield 44/32; J.M. 1993.

Trifolium tomentosum L. (63) Woodhouse Lane Farm near Wakefield 44/22; J.M. 1993.

Erodium stephanianum Willd. (63) Woodhouse Lane Farm near Wakefield 44/22; J.M 1993 det. E. J. Clement.

Lamiastrum galeobdolon ssp. *argentatum* (Smejkal) Stace (61) Plantation, Roos 54/22; P.J.C. First found 1989.

Silybum marianum (L.) Gaertner (63) Rawcliffe 44/62; E. Thompson per D.R.G.

Centaurea macrocephala Muss. Puschk. ex Willd. (61) Brandesburton 54/14; E.C. A garden escape, but neither house nor garden now exist.

Tragopogon porrifolius L. (61) Drain bank, Beverley 54/04; J. Dews det. E.C.

Pilosella aurantiaca ssp. *carpathicola* (Naeg. & Peter) Sojak (61) Wasteland at Withernsea 54/32; P.J.C. First found 1989.

Phalaris minor Retz. (61) Middleton-on-the-Wolds 44/94; J.D. conf. E.C.

Hordeum jubatum L. (61) Hedon by-pass 54/12; P.J.C. per Dr F. E. Crackles.

BOOK REVIEW

Forest Resources in Europe 1950-1990 by **Kullervo Kuusela**. Pp. xiv + 154, including 31 tables and 18 black and white figures. European Forest Institute Research Report 1, Cambridge University Press. 1994. £29.95.

This book presents the results of work at the European Forest Institute, established in 1993 to conduct research and gather statistics to inform European policies in forestry. It begins with a survey of the forest resources of Europe, dividing the area into nine geographical regions, such as 'Atlantic' and 'Mediterranean West'. Detailed statistics for each country appear in the next section, followed by a discussion of the ecological and economic basis of forestry. The book ends with recommendations for future forestry policy.

An estimated 80% of Europe was originally covered with forests but two-thirds have been destroyed over the years. Only in the twentieth century has there been a major reversal of this trend, with the development of forestry industries in most European countries. Despite some discrepancies in data collection and recording, it is clear that the total growing stock of European forests increased by 43% (5 million hectares) between 1950 and 1990, and wood resources are now greater than at any time in the last three hundred years. Forests presently cover 27% of Europe as a whole and the British Isles have the dubious distinction of having the lowest percentage forested area of all European regions. However, the only natural forests remaining are in parts of the boreal coniferous zone and a few montane remnants. The remainder are mostly planted, being dominated by coniferous species, except in southern Europe where much of it is scrub woodland.

Nearly all European forests are multi-functional today, with social and cultural functions, such as recreation, gradually gaining in importance relative to the traditional commodity function of providing timber and wood products. Forests are also important for protecting watersheds from soil erosion, as refuges for wildlife and as carbon sinks to counteract global warming.

Much of the book consists of tabulated statistics and graphs, which provide a valuable database but do not make for scintillating reading. The most interesting sections are in chapter 4, where the author discusses the problems of achieving sustainable development of forest resources and the future outlook for forestry in Europe. Comparisons are made between native woodlands and plantations of exotic conifers, the later being more susceptible to disease and pest attacks, windthrow and fire damage. He questions the long-term genetic and structural stability of these forests and makes a case for changes in management policies, such as shortening rotations, increasing thinnings and a return to the use of native species. Forests can make a valuable contribution to maintaining biodiversity but good management is hampered by low living standards in southern Europe and poor economic structures in the former planned economies of eastern Europe. The author argues that an environmental ethic should be developed and policies devised for European forestry as a whole.

The style and presentation are of high quality but the structure of the book produces some repetition of material and the emphasis on factual data does not make for an easy read. A somewhat dated approach is taken to zonal vegetation and 'climatic climax' communities, but despite this the book contains much useful information and some challenging ideas. This is a book for the serious student or forest manager and will form a valuable work of reference for several years to come.

MAA

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record this deep appreciation of this imaginative gesture.

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STATUS OF SPECIES RICH NEUTRAL GRASSLAND IN WESTERN NORTH YORKSHIRE

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SUMMARY

This paper brings together observations made by the author after carrying out a Phase 1 (field by field) survey for the Nature Conservancy Council in 1989-91 of all the neutral grassland in the western part of North Yorkshire, covered by the districts of Richmondshire and Craven, but excluding the Yorkshire Dales National Park. Grassland data collected within the YDNP by other NCC surveyors in 1985/86 are also used. The author also resurveyed 40 YDNP fields of high and medium conservation value in 1991 and showed that a 36% decrease in the recorded area of species rich neutral grassland had taken place between 1985 and 1991. This indicates that there were only 519 (±158) ha of grade 4 grassland (i.e. of high grade conservation value) in 1991 in the whole of the YDNP. Some of this loss is due to agricultural improvement and some is due to part of the original survey having had an insufficiently fine mapping scale. The England Field Unit indicator species list usedto grade fields was shown to be a very useful tool for comparing grassland habitats.The richest communities, i.e. those with 15 or more indicator species, were found almost entirely on slopes. The main NVC types in species rich grassland in the area under study are MG3, MG5, M26b, CG2 and CG8 with some M22 and M27, and the importance of M26b as a grassland vegetation type within the Dales is emphasised. Three of the 35 species rich grassland sites in Craven have come under threat in the three years since 1991. The importance of the Settle-Carlisle Line as a grassland habitat is demonstrated. A table comparing habitat type cover inside and outside the YDNP within Craven is presented.

INTRODUCTION AND AIMS

Since 1949, neutral grasslands in the UK have been changed by seeding, drainage and fertilizer and herbicide application, so that by 1984 95% lacked significant wildlife interest and only 3% were left undamaged by agricultural intensification (NCC, 1984). Damage is continuing (Barr *et al.*, 1993). Traditionally managed, unimproved (in agricultural terms) grasslands are an important wildlife resource containing a wide diversity of plants and insects which have lived in Britain for thousands of years and many of which would have grown in woodland clearings before humans came. Smith and Rushton (1994) describe management of traditional meadows from which stock are removed in May and the grass cut for hay from mid July to August.

This paper assesses the status of neutral grassland in the districts of Craven and Richmondshire, i.e. the western part of the county of North Yorkshire. It draws on the three Phase 1 (field by field) surveys of the area carried out by English Nature (EN) and its predecessor, the Nature Conservancy Council (NCC) (Table 1) and reports on a further survey by the author to investigate changes in the conservation value of a sample of high grade fields between 1985 and 1991.

The area, which lies in the Pennines, (Figure 1) is English Nature's "Yorkshire Dales" area of search. The NCC divided Britain into 114 areas of search. One third of the vegetation in the area surveyed is neutral grassland, grown to support cattle and sheep. The rocks are mostly carboniferous sandstones (including millstone grit), shales and limestones and there are areas of glacial and alluvial deposits.

Table 1 shows the three Phase 1 surveys which have been carried out in the area to provide EN with vegetation maps and target notes showing the conservation value of each field. In the two surveys outside the Park, carried out by the author, the remit was to pay special attention to neutral grassland.

TABLE 1
Yorkshire Dales Phase 1 Botanical Surveys

Survey	Total area km^2	Neutral grassland km^2	Notes
YDNP 1985-1988 (Stewart & Drewitt, 1989; Drewitt, 1991)	1532	411	The YDNP contains part of the Pennine Dales ESA including *Geranium sylvaticum* meadows at the top of Swaledale; other main habitats are heather and cottongrass moorland, acid, neutral and calcareous grassland.
Richmondshire 1989 (Allinson, 1992)	490	*c.*174	Much of the former enclosed grassland has been changed to arable; there is heather moorland on the millstone grit in the west and there is some limestone.
Craven 1990-1991 (Allinson, 1992)	370	262	Much of the neutral grassland of the Craven Lowlands on glacial till and drumlins is improved, in the agricultural sense. In South Craven there is millstone grit and in the south west part of North Craven, Bowland shale.

The YDNP survey was the first to be carried out because it was known that the Park is an important area for traditional hay meadows. The YDNP, the NCC and the Environmentally Sensitive Area (ESA) system have encouraged care for some of these meadows. Outside the Park there were thought to be fewer fields of conservation interest, so these surveys were carried out afterwards. However, the very fact that there are fewer good fields outside the Park means it is important to conserve those that remain.

A repeat survey of 40 fields in the YDNP which included 7.6% by area of the neutral grassland of highest conservation value was carried out by the author in July 1991. This enabled comparison of some of the best fields inside and outside the Park, thus ensuring that the same standards were being applied in both places. It also provided an excellent opportunity to determine whether the species richness of the fields had changed over the period 1985 to 1991.

Neutral grassland is taken to mean all the grassland types included in the Mesotrophic Grassland chapter of the National Vegetation Classification (NVC) (Rodwell, 1992). This chapter excludes acid grassland, calcicolous grassland and wetland. Other grassland vegetation communities were also included if they contained a high number of the England Field Unit's Yorkshire Dales Hay meadow survey list of species characteristic of semi-natural neutral grassland (NCC, 1982), and these communities were M26b (wet grassland), borderline cases of calcicolous grassland and enclosed calcicolous grassland that was ungrazed or managed as hay.

For the sample of YDNP fields the following questions were asked:

1. Has there been a reduction in the area of grade 4 and grade 3b grassland in the 5-6 years since 1985-86? Can the result from the sample survey be used to obtain an estimate for the amount of remaining high grade grassland in the YDNP?
2. What percentages of high grade sites are pastures or meadows?

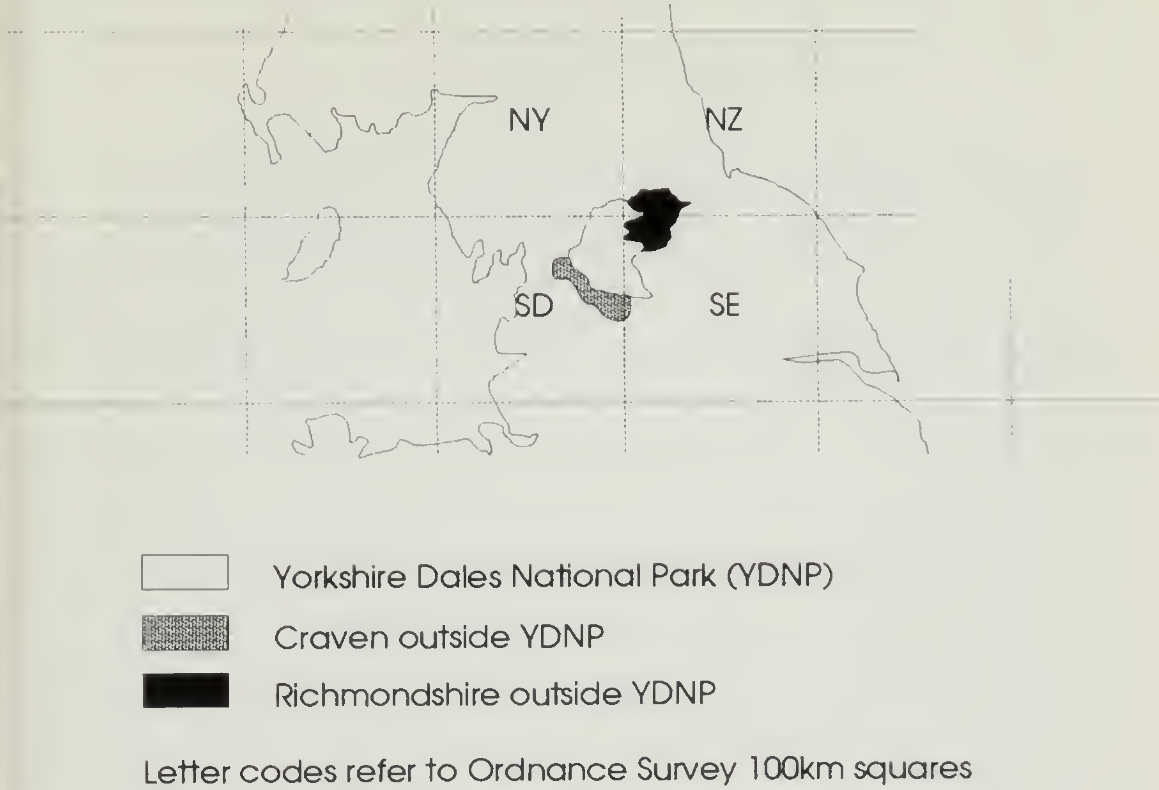


FIGURE 1
Location of area surveyed.

3. How important are slopes compared with flat areas in providing a habitat for species diversity?
4. What range of "indicator species score" occurs?
5. What range of National Vegetation Classification (NVC) types occurs?

Questions 2, 3, 4 and 5 were asked in the Craven survey for the 25 most species rich fields and questions 4 and 5 in the Richmondshire survey for the 27 most species rich fields. Question 4 was also applied to 18 sites along the Settle-Carlisle Railway in the YDNP using data collected by the author with the Craven Conservation Group (1989).

METHODS

Neutral grassland grade

A scheme to classify neutral grasslands using a list of 47 indicator species (Table 2) was used by the England Field Unit when they surveyed Yorkshire Dales hay meadows in 1980 and 1981 (NCC, 1982). The list was originally compiled as a result of field experience in Derbyshire, Cumbria and North Yorkshire. The species are those characteristic of semi-natural neutral grassland in northern England, including traditionally managed hay meadows, and in this text are referred to as indicator species.

Grade 1+2	– no indicator species (i.e. heavily improved or reseeded)
Grade 3a	– 1-4 indicator species present
Grade 3b	– 5-9 indicator species present
Grade 4	– 10 or more indicator species present.

High conservation interest and traditionally managed sites tend to be grade 3b and grade 4. Some sites with fewer than five indicators may also be of conservation interest if they support uncommon plants. Some traditionally managed meadows have low scores, e.g. grade 3a, because they are supported on acid soils.

TABLE 2

Indicator species – both characteristic and rare – used in the identification of herb-rich meadows (from EFU Survey Report, NCC, 1982)

Species names given according to Stace (1992).
Strategy: (Grime *et al.*, 1988) C = Competitor, R = Ruderal, S = Stress tolerator.

Species Characteristic of Old Meadow Communities (34 species)		Rare Species of Old Meadows (13 species)
Ajuga reptans		*Botrychium lunaria*
Alchemilla spp.		*Cirsium heterophyllum*
Alopecurus geniculatus		*Dactylorhiza fuchsii*
Anemone nemorosa	S/SR	*D. maculata*
Briza media	S	*D. purpurella*
Caltha palustris	S/SCR	*Gymnadenia conopsea*
Carex caryophyllea	S	*Listera ovata*
C. flacca	S	*Meum athamanticum*
C. panicea	S/SC	*Ophioglossum vulgatum*
Conopodium majus	SR	*Persicaria bistorta*
Euphrasia spp.	SR	*Platanthera bifolia*
Filipendula ulmaria	C/CR	*Primula farinosa*
Galium verum	S/SCR	*Trollius europaeus*
Geranium pratense		
G. sylvaticum		
Geum rivale		
Helictotrichon pratense	S/SC	
H. pubescens	S/SC	
Hypochaeris radicata	SCR	
Knautia arvensis		
Lathyrus pratensis	SCR	
Leontodon hispidus	S	
Lotus corniculatus	S/SCR	
Luzula campestris	S/SCR	
Lychnis flos-cuculi		
Plantago media		
Primula veris	S	
Prunella vulgaris	SCR	
Sanguisorba minor	S	
S. officinalis		
Saxifraga granulata		
Stachys officinalis	S	
Stellaria graminea		
Succisa pratensis	S	

In the Craven area outside the YDNP, with three possible exceptions, no hay meadows of high conservation interest (grade 4) were found. However, neutral grassland of high

conservation interest was found in sites such as pastures, neglected slopes, verges and boggy ground. These areas were often less than 0.5 ha, the standard cut-off for most NCC grassland survey work.

Location of fields for YDNP resurvey

The 40 fields were chosen by a restricted randomised method: two grade 4 and two grade 3b sites were selected from different parts of each YDNP Phase 1 5km x 5km map so that the chance of the fields being managed by the same farmer was reduced; where possible those selected had a footpath running through them. The 5km x 5km squares, often with less than four suitable fields, were then surveyed in a random order, until 40 sites had been recorded.

This resulted in 24 fields for grade 4 grassland, covering 57.2 ha (7.6% of YDNP grade 4 grassland) and 16 fields for grade 3b grassland covering 35 ha (1.7% of the total grade 3b grassland).

Sampling

The survey was carried out in the four weeks of July 1991. Each field was considered as a site which could be made up of one or several different communities. Each community was traversed and a species list made with DAFOR ratings, according to a five point abundance scale (Dominant, Abundant, Frequent, Occasional and Rare) estimated by eye. The results were entered on target note cards and the area covered by each neutral grassland grade was recorded. For the more interesting communities, standard NCC grassland cards were completed; this involved placing a 2m x 2m quadrat and recording the Domin values to provide percentage cover for each species present. The communities were then allocated to NVC types with the aid of the computer program MATCH (Malloch, 1990) and the NVC chapters (Rodwell, 1991, 1992).

In cases where hay meadows were uncut, the field was viewed with binoculars from the path and edges and the quadrat placed in a representative part near the edge of each community. In cases where no footpath was available, access permission was sought from the landowner.

Pastures and Meadows

The 40 fields surveyed were recorded as being either pasture or meadow; this includes two completely neglected, ungrazed fields which were counted as meadow. Graphs of the results were made to compare indicator species scores in pasture and meadow.

A separate, more extensive analysis was also made to find the ratio of pastures to meadows in high grade grassland throughout the YDNP using the Phase 1 maps, stored at the English Nature office in Leyburn. A sample of 15 maps, from the total of 61 5km maps which contained more than 50% YDNP, was taken and all fields recorded as grade 3b or 4 were categorised as either pasture or meadow and counted.

Area covered by different vegetation types in Craven inside and outside the YDNP

The Phase 1 maps have been analysed using a dot matrix grid to calculate the percentage cover of different vegetation types (Stewart & Drewitt, 1989; Allinson, 1992). The results for Craven inside and outside the YDNP are shown in Table 4. It is thus possible to compare the area of species rich grassland with the area of other types of vegetation.

Results and Observations

Current area of grade 4 and grade 3b grassland

Figure 2 shows that, for the 40 fields surveyed in 1991, about one third of the land recorded as grade 4 or 3b in 1985-86 can no longer be classified as such. By 1991 much had changed to grade 3a land and 3.6 ha was improved grassland with no indicators at all. Using the data from these 40 fields it is possible to make an estimate of how much of the grade 3b and 4

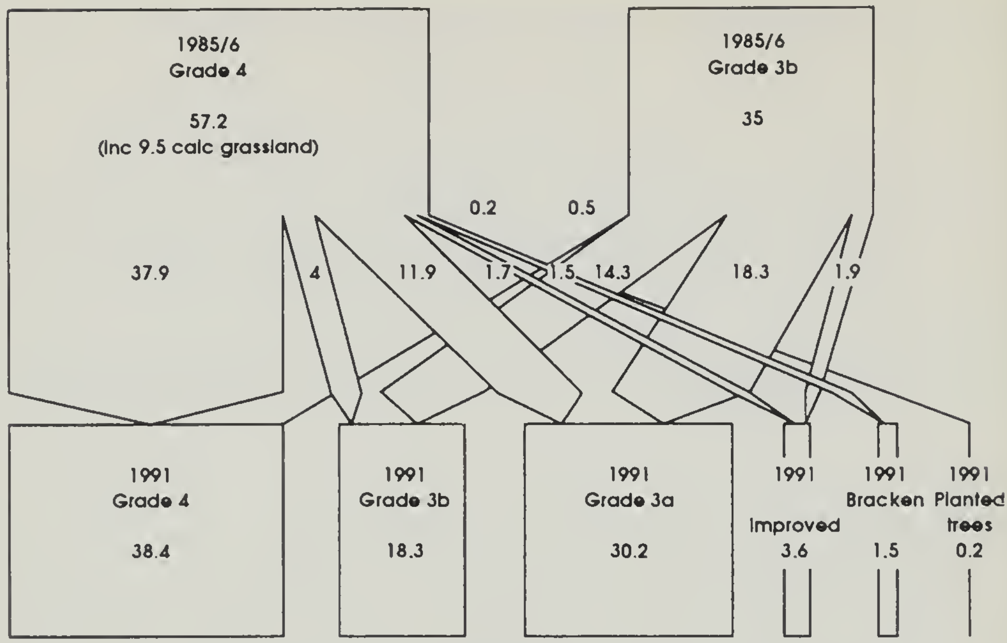


FIGURE 2
To show the fate in 1991 of 40 fields recorded as grade 4 or 3b in 1985/1986 in the YDNP (hectares).

grassland recorded in 1985 in the YDNP remained in 1991. The standard error of the mean change in area of the communities in these fields is used to calculate the 95% confidence limits. Five additional small grade 4 sites were found and these are added to the results to give a second estimate.

Cover of grade 4 grassland in 1985	= 754 ha	
Estimated grade 4 cover in 1991	= 500 ±147 ha	(66.3 ± 19.5%)
As above but including new sites found	= 519 ±158 ha	(69 ± 21 %)
Grade 4 and 3b grassland cover in 1985	= 2688 ha	
Estimated grade 4 and 3b cover in 1991	= 1653 ± 515 ha	(61.5 ±19%)
As above but including new sites found	= 1723.5 ± 515 ha	(64 ± 19%)

The five additional grade 4 sites found had a combined area of 1.5 ha and consisted of one calcareous grassland with no target note, two road verges, one strip at the edge of a school field and an area of 0.5 ha that had previously been described as 3b. New grade 3b grassland had not been recorded during the project. Since extra grade 4 land had been found amounting to 2.6% of the final grade 4 area, it was decided, as a rough estimate, to make the extra grade 4 and 3b land equivalent to 2.6% of the final grade 4 and 3b area (2688 ha), i.e. 70.5 ha. This figure of 70.5 is simply added to the figure of 1653 ha calculated above. It is not possible to calculate different confidence limits.

Loss due to change in management

Two fields, originally recorded as grade 4 and 3b in 1985, occupying 5% of the area of the 40 fields, were considered to have lost species richness through management regimes, especially application of fertilizer. Spraying with herbicide against weeds such as thistles could also have been involved. In 1991, they were found to be lush, rank, improved meadows with no hay meadow indicators at all except in a small wet area in one field and in a 1m² slope in the second field where each had more than five. Three other fields recorded in 1985 as grade 3b were found in 1991 to have lush growth and only 3 to 4 thinly

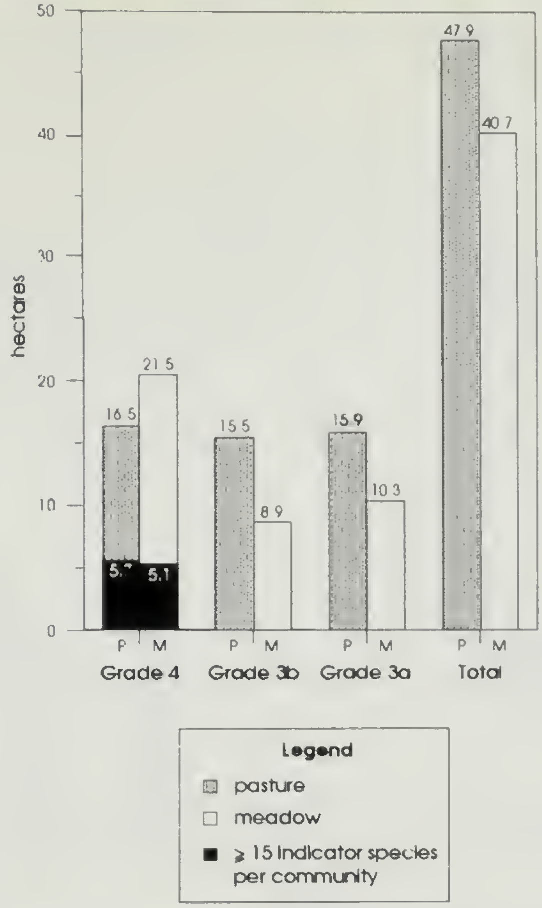


FIGURE 3
Grassland quality in pasture and meadow in 1991 in 40 fields recorded as grade 4 or 3b in 1985/1986 in the YDNP.

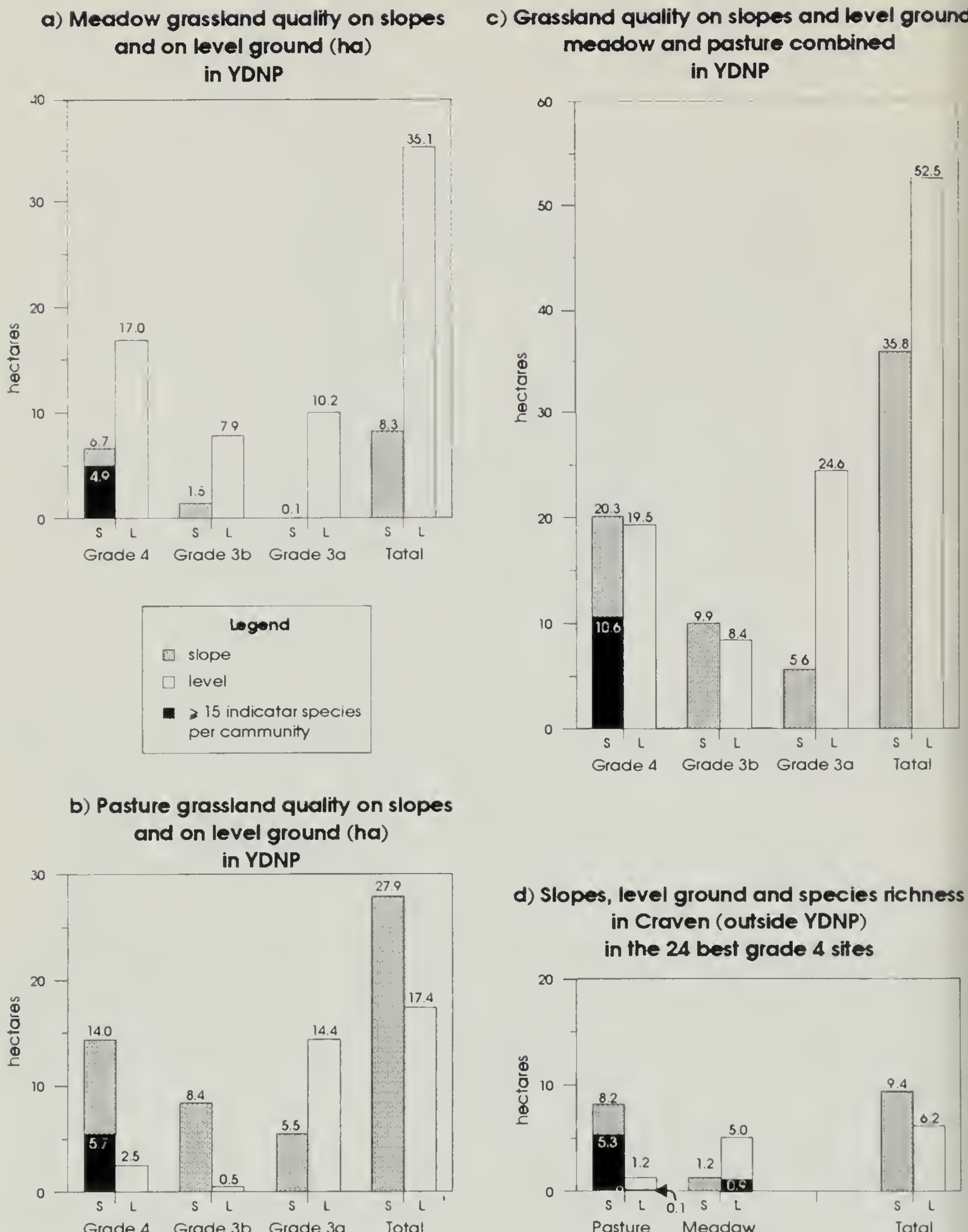
dispersed indicators and hence were recorded as 3a. These may have been borderline cases even in 1986. Thus out of the initial 93 ha, agricultural improvement is likely to be the cause of the loss of at least 5% of the species rich grassland, and if all the above five fields are included, as much as 12.7%.

A 0.1 ha strip of grade 4 flush grassland between a stream and wall was lost to tree planting and 1.5 ha of steep calcareous slope is now covered by bracken.

Meadow, pasture, slope and species diversity

An analysis was made of a sample of 15 of the 61 5km x 5km maps from the 1985/86 NCC survey to find the relative abundance of meadows and pastures. When the grade 4 and 3b fields were totalled for the first 14 maps, the ratio of meadow to pasture was 1:2 (grade 4: 24 meadows, 61 pastures; grade 3b: 60 meadows, 105 pastures). By chance, the 15th map was SD99NW, Muker, and when the results for this map were added, it changed the score to 1:1. The Muker square had more hay meadows in it than all the other squares put together, with a ratio of meadow to pasture of 7.1 (grade 4: 30 meadows, 0 pastures; grade 3b: 62 meadows, 13 pastures).

It was observed that nineteen of the 179 grade 3b and grade 4 pastures (i.e. 10%) and one of the meadows used in the above analysis can also be classified as calcicolous grassland, but as they had high indicator species scores they are treated here as neutral grassland.



Footnote:

The YDNP results are community results from the sample of 40 originally grade 4 or 3b fields plus the 4 new small grade 4 sites.

FIGURE 4

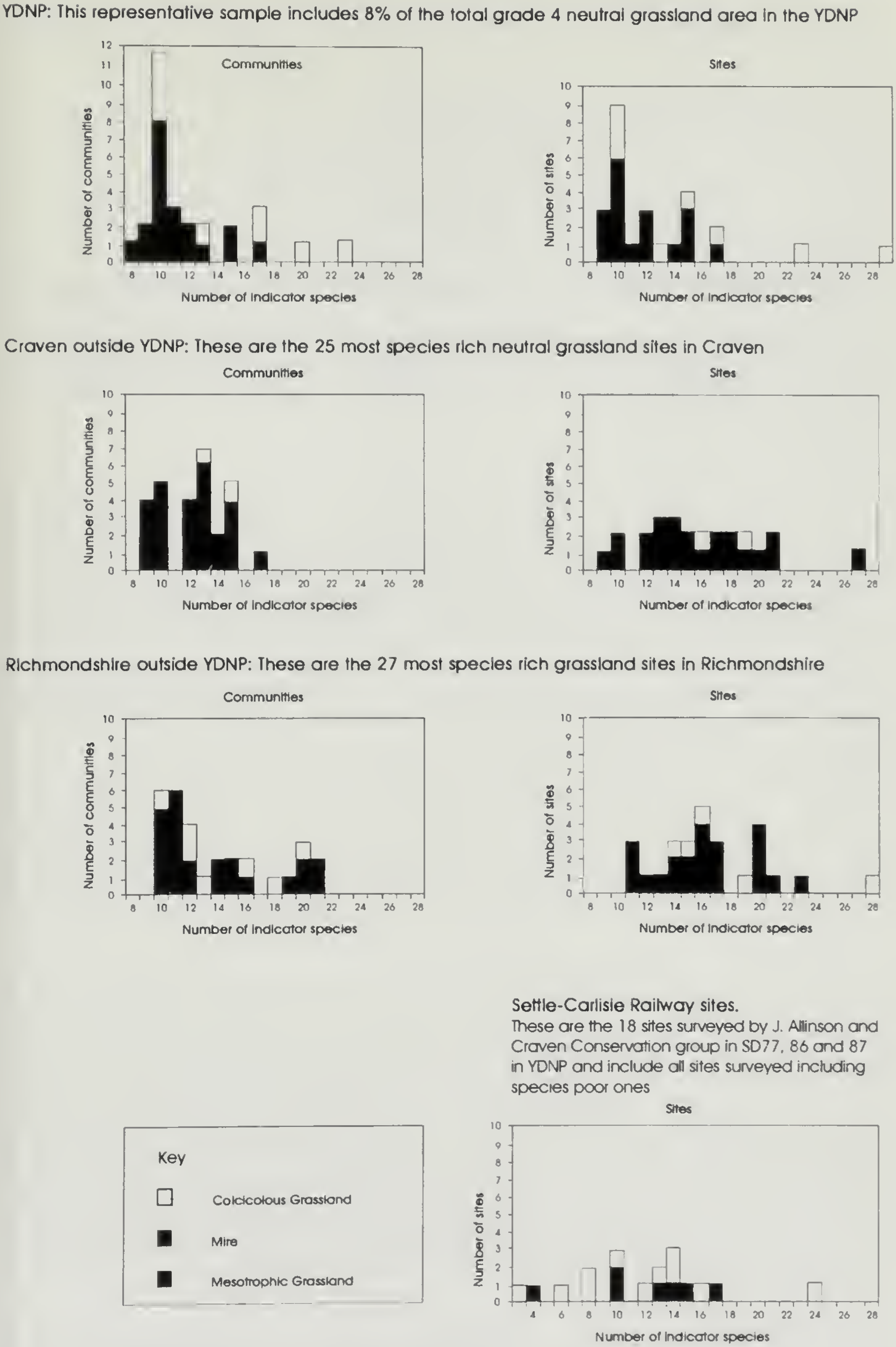


FIGURE 5
Range of Indicator Species Scores.

To consider whether pastures or meadows yield the higher grade of grassland, see Figure 3: of the sample of 40 fields surveyed in 1991, 18 were meadow and 22 pasture. There was slightly more grade 4 vegetation in meadow than pasture, whereas there was more lower grade vegetation (3a and 3b) in pasture than meadow. Also the 5km x 5km map survey above showed that the Muker square with the highest number of high grade fields had a very high ratio of meadows to pastures. However, the total area of very high grade vegetation (15 or more indicator species) was divided equally between meadow and pasture, though found only in seven fields.

Figures 4a and 4b show that in the YDNP all the grassland communities with more than 15 indicator species were found on slopes in both meadow and pasture. Figure 4c shows that whilst there was the same area of grade 4 vegetation on slopes as on the flat areas, 20.3 ha compared with 19.5 ha, vegetation with more than 15 indicators occurred almost exclusively on slopes. The same pattern was found in Craven (Figure 4d). Thus, for the sample of 40 species rich fields, flat meadows tend to have more indicator species than flat pastures, but if there is a slope in the field it will tend to increase the diversity of species for both meadow and pasture.

Indicator species score ranges

Figure 5 shows the distribution of indicator species scores for both communities and sites. The graphs show that many of the highest scoring communities are in fact calcareous vegetation. Craven has very few calcareous sites, but its neutral grassland sites score highly.

It can be seen from Figure 5 that although Craven and Richmondshire have fewer grade 4 sites than the YDNP, the distributions of indicator scores within the grade 4 sites are only slightly different. If the calcareous and mire sites are excluded then the differences become more obvious, the number of communities with 13 or more indicator species being 4 for YDNP, 9 for Craven and 10 for Richmondshire. If calcareous grassland is included then the numbers of communities with very high indicator species totals (17 or more) are 6 for YDNP, 1 for Craven and 7 for Richmondshire.

In 1989, the Craven Conservation Group, including the author, carried out a survey of 18 sites along the Settle-Carlisle Railway within grid squares SD77, 86 and 87. The YDNP survey did not have access to the line. The sites are up to 0.5 km long and the width of one side of railway banking and were not divided into communities. The indicator species scores for all the sites are included in Figure 5d, not just the grade 4 sites as in the case of the other surveys. Many of the railway sites are calcareous grassland.

NVC classification

Figure 6 shows the NVC types which occur in the high grade grassland of YDNP, Richmondshire and Craven. The computer program MATCH (Malloch, 1990) was used to aid identification of communities in Craven and the YDNP, but not in the Richmondshire survey. The code, title and a short description of these are given in the appendix.

Craven had a higher proportion of MG5 (*Centaurea nigra – Cynosurus cristatus* meadow and pasture) than the YDNP and Richmondshire, whereas these latter two areas had a higher proportion of MG3 (*Anthoxanthum odoratum – Geranium sylvaticum* meadow and pasture) than Craven. Small communities of M26b (*Molinia caerulea – Crepis paludosa* mire, *Festuca rubra* subcommunity) turned up many times in all three survey areas – species rich wet grassland characterised by *Valeriana dioica*, *Succisa pratensis*, *Carex panicea* but rarely containing *Molinia caerulea* or *Crepis paludosa*.

Mean community size

Figure 7 shows that the YDNP 1991 mean community size was much smaller that the YDNP 1985 mean community size and that the 95% confidence limits only just overlap, even though the same set of fields were measured in each case. The Richmondshire and Craven communities are smaller.

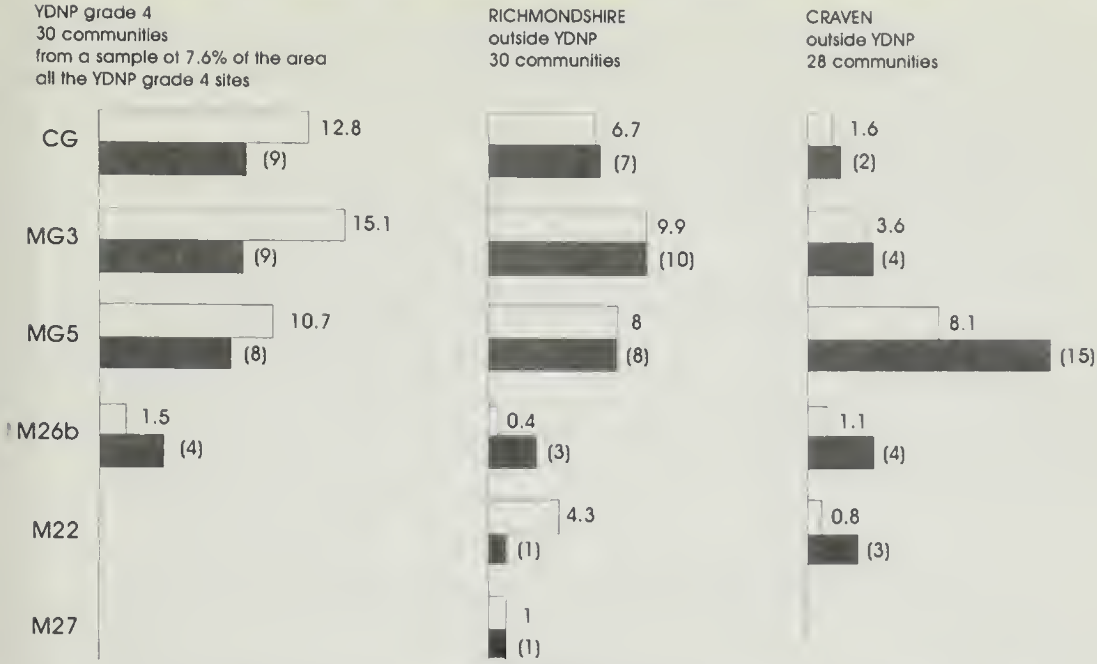


FIGURE 6

NVC types in grade 4 grassland in YDNP, Richmondshire and Craven: their total area (ha) ▭ and the number of communities (in brackets) ▬

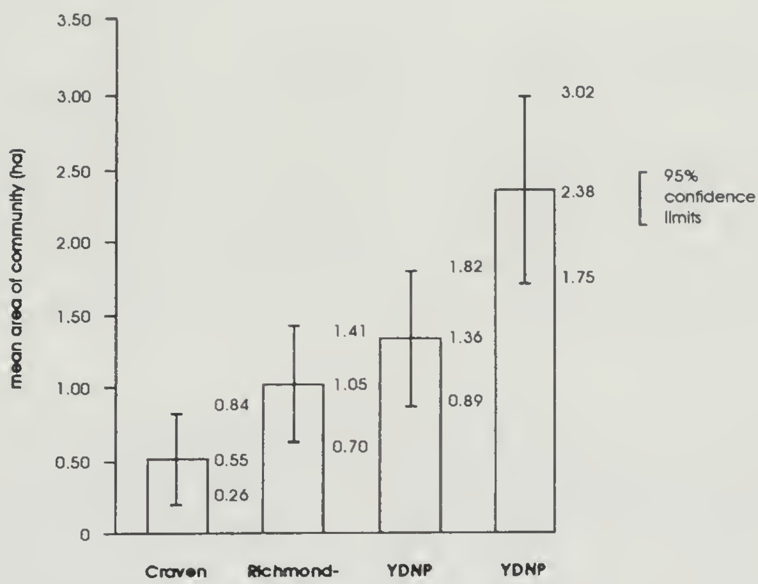


FIGURE 7

Mean areas of grade 4 communities in Craven, Richmondshire, YDNP (1991) and YDNP (1985).

Status and Protection of high grade sites

Tables 3 and 4 are presented to show the importance of high grade neutral grassland. Table 3 shows the relative amount of high grade neutral grassland in the different survey areas. Table 4 shows the percentage cover of all the main different vegetation types in

Craven inside and outside the YDNP and demonstrates the very small quantity of medium and high grade (3b and 4) neutral grassland that is left in these two areas. Inside the Park, which is supposed to be a good area for grassland, only 1.2% of neutral grassland is grade 3b and above; only 0.24% is grade 4 grassland. In Craven outside the Park only 0.24% is 3b and above, only 0.12% is grade 4 grassland.

Table 5 shows what protection or status is given to those grade 4 sites recorded in the three areas. It should be remembered that the YDNP sites are only a sample of all the sites in the YDNP, and that the majority of the railway line in use was not surveyed.

Three of the 25 species rich grassland sites in Craven have come under threat in the three years since 1991, due to planning applications. It will be easier for planners in Craven to protect important sites from development once the Local Plan for Craven District outside the National Park (currently at consultation draft stage) has been adopted. The YDNP already has its own plan. However, unless a field has SSSI status or a specific management agreement, there is nothing to prevent the landowners from agriculturally improving the fields, thereby destroying the nature conservation interest.

TABLE 3

A comparison of the total area (ha) of species rich grasslands in a) Craven outside the YDNP; (b) Richmondshire outside YDNP; (c) YDNP, determined from Allinson (1991)

<table>
<tr><th></th><th></th><th colspan="2">Neutral, calcareous and acid grassland</th><th colspan="2">Neutral grassland*</th></tr>
<tr><th>Total number of indicator species</th><th>Grassland Class</th><th>Craven 37000 ha</th><th>Richmondshire 49000 ha</th><th>YDNP 1985 153200 ha</th><th>YDNP 1991 153200 ha estimates</th></tr>
<tr><td>1–4</td><td>3a</td><td>947 (2.55%)</td><td>1200 (2.45%)</td><td>12994 (8.5%)</td><td></td></tr>
<tr><td>5–9</td><td>3b</td><td>46 (0.12%)</td><td>37 (0.08%)</td><td>1934 (1.26%)</td><td>1354 (0.9%)</td></tr>
<tr><td>10–14</td><td>4</td><td>22 (0.06%)</td><td>30 (0.06%)</td><td rowspan="2">754 (0.49%)</td><td>381 (0.25%)</td></tr>
<tr><td>≥15</td><td>4</td><td>24 (0.06%)</td><td>30 (0.06%)</td><td>138 (0.09%)</td></tr>
</table>

*The 6477 ha of calcareous grassland present in YDNP not listed here may also have some hay meadow indicator species.

Discussion

In the sample of 40 YDNP fields there was a 31% decrease in area of grade 4 grassland since 1985/6 and a decrease of 36% for grade 3b and grade 4 combined. If this is representative of all the high grade grassland in the YDNP, it represents a very significant loss. The confidence limits for the estimate for the whole YDNP are wide because the raw data for change in cover have a skew distribution, a large number of communities having no change or a small change in area and a few having big changes. None the less, the drop is significant and the pattern is reinforced by the fact that both the grade 4 and the grade 3b show a similar drop. This drop is due to two factors: first a change in minimum mapping area between the two surveys and second, changes in management which account for at least one third of the loss, or over 12% of the original grade 3b and grade 4 area.

The cut-off size for the minimum mapping area in Phase 1 survey work is often set at 0.5 ha by NCC/EN as a compromise between recording very fine detail and achieving a cost effective rate of survey work. This probably explains why the additional small grade 4 sites were not recorded in 1985. In the 1991 YDNP survey a scale finer than 0.5 ha was used which resulted in smaller mean community size (Figure 7). Some fields recorded, as for

TABLE 4
Area in Craven covered by different vegetation types outside and inside the YDNP.

Total area km²	Craven outside YDNP 370 % cover	Craven inside YDNP 792 % cover
Grade 4 and 3b grassland	0.24*	1.1
Neutral grassland of no conservation interest	70.1	31.3
Fen	0.1	0.4
Basic flush	0.04	0.2
Rush pasture	4.4	20.1
Acid grassland	5.1	
Eriophorum vaginatum bog	2.9	16.9
Acid flush	0.3	0.7
Heather	5.0	5.1
Scrub	0.2	0.3
Conifer	1.3	2.5
Mixed woodland	0.5	0.4
Bd lvd new plantation	0.6	1.0
Bd lvd older plantation/semi-natural woodland	1.0	
Bracken	0.6	1.7
Buildings and roads	5.1	1.0
Railway	0.6	–
Quarry	0.3	0.4
Water	0.7	0.63
Limestone pavement	0	1.7
Calcareous grassland	0.08*	6.0
Unrecorded (no access)	–	9.3

*Outside the YDNP the 0.08% calcareous grassland is also included within the grade 4 and grade 3b grassland.

TABLE 5
Protection given to grade 4 sites in 1993.

	YDNP	Craven	Richmondshire	S/C Line
SSSI	3	2	5	
ESA	≥4			
Countryside Stewardship			1	
YWT management agreement		1		
Road verge	2	2	1	
Railway land – disused line		5	1	
Railway land – active line				13
School nature reserve	1			
None of the above 'protection'	9	15	19	0
Total number of grade 4 sites	19	25	27	13

example all grade 4 in 1985, were in 1991 recorded as a small area of grade 4 grassland, less than 0.5 ha, and a large area of low grade grassland. This happened in 7 out of the 8 Arkengarthdale sites, all of which were recorded by the same 1985/6 surveyor. In their report Stewart and Drewitt (1989) state "there has been a general increase in the detail of mapping since the first field season in 1985". It is unfortunate that this difference in technique occurred because it is now not possible to attribute an exact area of high grade grassland loss to management practice, but it should be noted that the original survey was not carried out with the intention of a specific resurvey. Furthermore, whatever the cut-off scale used, a choice does have to be made.

There were however obvious losses of species diversity due to changes in management, especially increased application of fertilizer. A loss of five grade 4 and grade 3b communities out of 40 in 5 years is a large rate of loss. Of interest are two other changes in management which reflect current trends: a strip in one field was lost to tree planting and a steep slope in a second to bracken encroachment.

The meadow to pasture ratio was considered in relation to the question "Are there more likely to be plants of conservation interest in meadow or in pasture?" Tall plants such as *Geranium pratense* and *Geranium sylvaticum* will only survive in fields which have tall vegetation in summer. Traditionally managed meadows have been and are still being lost: on the one hand, as productive meadows their yields are further increased by addition of fertilizer and reseeding, and on the other, as the less productive and inaccessible ones cease to be managed as meadow and are left as pasture. Indeed, some of the best pasture fields found were ex-meadows. The anomalous result for the meadow to pasture ratio of 7:1 for the Muker square compared with a mean of 1:2 in the other 14 recorded squares in the YDNP shows that the ratio depends on which part of the Park is being sampled. In Craven outside the Park there were very few species rich traditionally managed meadows at all – partly because in places the parent rock, especially the millstone grit and Bowland shale, was more acid and hence the vegetation more limited, and partly because they had been lost as described above. The special combination of climate, geology, topography and history around Muker in Upper Swaledale has enabled these meadows to survive – the shortish growing season, the limestone, the steep slopes and flat valley floor, the work in the lead mines, the isolation, and over the last ten years or so the ESA system.

Slopes had greater species richness than flat areas. Various suggestions can be put forward for this. Firstly the flat areas often have deposits of boulder clay or alluvial material, giving a thicker top soil which allows the more vigorous plants to grow, which in turn exclude the slow growing stress tolerant plants. Secondly the slope soils have a thin A horizon, fewer nutrients are available and therefore the plants are smaller, leading to larger gaps due to low vegetation cover and soil slippage, so there is space for a variety of plants to become established. Thirdly, the slopes are often more calcareous than the flat areas and finally the slopes do not get cut in summer, and manure and fertilizer would not be applied.

The range of indicator species scores is not dramatically different for the three survey areas. Richmondshire and the YDNP have more communities with a very high number of indicators (17 or more) than does Craven, possibly because they have more surface limestone rock. Several MG3 and MG5 communities were found in limestone fields. However, Craven and Richmondshire have more sites with high scores than the YDNP sample; one small field site can be made up of several different communities and hence achieve a high score. Some of the railway sites have high scores, showing the importance of the railway line for the conservation of grassland species.

The choice of species in the indicator species list is of interest (Table 2). Grime, Hodgson and Hunt (1988) have studied grassland species near Sheffield and classified them as competitors, stress tolerators or ruderals (opportunistic weeds) or a combination. Stress tolerators tolerate soil of low fertility – if fertilizer is added plants with competitive strategies will grow quickly and displace them. The indicator species list includes 22 species which they studied and 18 of these are either stress tolerators or a combination of stress tolerator and another strategy. The exceptions are *Filipendula ulmaria* which is

recorded as a competitor/competitor ruderal and *Hypochaeris radicata*, *Lathyrus pratensis* and *Prunella vulgaris* which have a central combination of all three strategies.

Table 6 shows how many constant species each of the five main NVC types have and how many of the constant species are actually England Field Unit indicator species. (See the appendix for notes on the NVC communities.) MG3 and MG5 have fewer indicator species as constant species than the non-mesotrophic grassland types (only 4 and 1 as compared with 6, 6, and 7). The subcommunities of MG3 and MG5 do have slightly higher values than their parent communities, but still not as high as CG2, CG8 and M26b. However when the total list of species to be found in the NVC types is examined, MG3 and MG5 score well (25 and 23) compared with CG2 (18) CG8 (20) and M26b (25). Whether considering the number of constant species or the total species list, M26b scores highly for indicator species. It is a vegetation type to be valued in the Dales.

During the period of five years between the two surveys a significant amount of high grade neutral grassland was lost. Approximately 12% of this already scarce resource was lost due to management. It is almost five years since the second survey was carried out. The data from the second survey would form a good basis for a repeat survey to determine whether loss of species diversity is continuing.

TABLE 6
Indicator species and NVC communities.

NVC	Type	Number of constant species	Number of constant species that are indicator species	Number of indicator species that occur at least occasionally	Number of rare indicator species
CG2		13	6	18	2
CG8		16	6	20	2
MG3		15	4	25	2
	MG3a	15	5	25	2
	MG3b	19	4	20	2
MG5		10	1	23	1
	MG5a	13	1	23	1
	MG5b	14	2	20	1
	MG5c	17	4	14	1
M26b		19	7	25	2

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Appendix

The National Vegetation Classification was written to help people communicate with each other about Britain's vegetation using a standard national system. The text in the NVC chapters link the many other different systems that have been used in the past with the NVC system. Vegetation is a continuum and many field communities lie midway between several NVC types, which can make their classification difficult, but it is worth the effort so that everyone can use the same system. English Nature try to have good representation of certain NVC types in their system of Sites of Special Scientific Interest.

The definition of species rich neutral grassland in this survey has come to have a wider meaning than simply those communities in Rodwell's Mesotrophic grassland chapter. It has come to include all vegetation types except woodland that have a high number of indicator species.

A comparison of the main NVC types found in species rich grassland in the survey areas is given below. In NVC terminology a constant species is one which occurred four or five times out of five when 2m x 2m quadrats were placed in the original communities used to define the NVC types. The species in the title are constant species but do not always occur in the communities as found in the field. Nomenclature is according to Clapham *et al.* (1987).

MG3: *Anthoxanthum odoratum – Geranium sylvaticum* meadow and pasture (species rich traditionally managed Dales Hay Meadow). *Alchemilla glabra, Sanguisorba officinalis, Cerastium fontanum* and *Conopodium majus* are those species which are constant species for this communty but are uncommon in the other communities listed here. Many other species of *Alchemilla* also occur in MG3.

MG5: *Centaurea nigra – Cynosurus cristatus* meadow and pasture (species rich traditionally managed Lowland Meadow). There is a wide range of species but no constant that does not grow in abundance in at least one of the other communities.

CG2: *Festuca ovina – Avenula pratensis* grassland.

CG8: *Sesleria albicans – Scabiosa columbaria* grassland.

Both these calcicolous grassland types have the following constant species: *Pimpinella saxifraga, Avenula pratensis, Sanguisorba minor, Koeleria macrantha, Linum catharticum, Scabiosa columbaria* and *Thymus praecox*. CG2 does not have *Sesleria albicans* and it has much less *Centaurea nigra* than CG8.

M26b: *Molinia caerulea – Crepis paludosa* mire, *Festuca rubra* subcommunity. This is species rich wet grassland noticeable for constants: *Valeriana dioica, Succisa pratensis, Carex panicea*, often with further constants: *Geum rivale, Stachys betonica, Filipendula ulmaria* and *Briza media*. *Molinia caerulea* and *Crepis paludosa* were rare in the current survey.

M22: *Juncus subnodulosus – Cirsium palustre* fen meadow. In North Yorkshire *Juncus subnodulosus* is very uncommon and is approaching the NW edge of its distribution in Britain.

M27: *Filipendula ulmaria – Angelica sylvestris* mire.

BOOK REVIEWS

The European Garden Flora. Volume IV. Dicotyledons (Part II), Dilleniaceae to Leguminosae. Edited by **S. M. Walters** ***et al.*** Pp. xviii + 602. Sponsored by The Royal Botanic Garden, Edinburgh, The Royal Horticultural Society, London and The Stanley Smith Horticultural Trust, Cambridge. Cambridge University Press. 1995. £95.00.

It is not surprising that the latest volume of this prestigious work has taken six years to appear since its predecessor as it covers some of the largest and most problematic plant families, such as Cruciferae, Rosaceae and Saxifragaceae. The impeccably high standard set by previous volumes (see *Naturalist* **111**: 144, 1986 and **115**: 20, 1990) is fully maintained, not only in terms of style and content, but also usefulness; furthermore, this particular volume, the most substantial to date (covering 32 families), contains a revised key to all the families of the Dicotyledons.

A major feature of this work is its intelligibility, not only to professional botanists but to all those seriously interested in horticultural plants. As well as succinct taxonomic descriptions of families, of genera and of each plant based on the highest scientific standards, the work is also of considerable practical importance in providing keys to specific level; where difficult plant groups are involved, the text is complemented in many instances with line drawings of diagnostic details. In addition, each plant entry includes one or more references to other published descriptions and at specific level in almost all cases users are directed to the best published illustration. Brief notes on soil preferences and other cultural requirements are generally provided.

This is without question one of the key botanical works published this century and will provide a major reference source for many decades to come. Although the price will preclude many individuals from owning personal copies of this seminal work, they should make every effort to encourage libraries and academic institutions throughout the country to acquire a set.

VAH

Scarce Plants in Britain compiled and edited by **A. Stewart, D. A. Pearman** and **C. D. Preston**. Pp. 515, with 404 maps. Joint Nature Conservation Committee, Peterborough. 1994. £34.00 plus £3.00 postage & packing from: Natural History Book Service Ltd., 2-3 Wills Road, Totnes, Devon TQ9 5XN.

The British flora is probably the best studied in all the world, and as a consequence of the long and distinguished history of plant recording it is possible to monitor changes in

it quantitatively.

The present work provides a detailed state-of-the-art interpretation of the present status of 325 species of ferns and flowering plants here defined as 'scarce'. This catalogue complements the *British Red Data Book: 1 Vascular Plants* by F. H. Perring and L. Farrell (1977, 2nd ed. 1983) in recognising plants which some botanists would accomodate in a 'Pink' Data Book. The species included occur in only 16 to 100 of the 10km x 10km grid squares and in many cases are certainly declining due to general habitat destruction, particularly of grassland, heathland and wetland, through farming and industrial practices, and urban encroachment.

Such catalogues are only made possible by long-term fieldwork, carried out in this case by many individuals, including more than 1,100 members of the Botanical Society of the British Isles, and by the careful collation of their data by the National Biological Records Centre. The succinct yet informative texts which accompany the detailed species maps and calculations have been prepared by 102 contributors, who, together with the editors and publishers have produced a volume worthy of this country's botanical endeavour.

MRDS

The Naturalist in Britain. A Social History by **David Elliston Allen.** Pp. xx + 270, with numerous line drawings and b/w plates. Princeton University Press. 1994. £11.95 paperback.

A welcome return of an old favourite. This much acclaimed work by David Allen, first published in 1976, has been out of print for many years and indeed was always difficult to obtain in North America and other countries. Although concerned solely with British natural history, which is unique in terms of its long and remarkable history, this original and scholarly work will now be appreciated by many botanical historians worldwide.

This republication under a respected American imprint now has a different format in terms of its typography, layout and illustrations (usually larger); as to new content, however, the author provides only a l-page preface. Such a definitive work, which covers the period up to the early part of the 20th century, could hardly have been improved upon, but perhaps the opportunity should have been taken to provide at least a list of additional sources of published information in a subject area which has greatly increased in popularity over the past two decades – in large measure the result of David Allen's pioneering achievement.

MRDS

Beneath the Lakeland Fells: Cumbria's Mining Heritage by The Cumbria Amenity Trust Mining History Society. Pp. 192, including 132 b/w photographs, and 6 distribution maps. Red Earth Publications 1992. £10.

Anyone who takes an interest in the Lake District landscape or the history of British mining will find this book of more than passing interest. It consists of eight thematic chapters, each one devoted to the production of a particular mineral. Each section has been written by enthusiasts who have distilled their specialist knowlede to create fascinating, informative accounts of the history and relicts of the Lake District's mining activity. Chapters are devoted to copper, wad (graphite), slate, iron, wolfram (tungsten), lead and zinc, coal and barytes and there is a useful glossary and bibliography.

Each section is illustrated with a wealth of large photographs depicting present day relicts or scenes from the past when active mineral working was taking place. Collectively, the photographs and accompanying text provide an insight to the world of stopes, cross-cuts, kibbles, buddles and other mining operations which once permeated the Lakeland fells and supported many of the villages which present day tourists frequent. As the relicts from the Lake District's industrial past are progressively being swept away, this book is especially welcome, by providing a clear record of the past with first class illustrations or items which are inaccessible to the normal visitor but vital if we are to fully interpret the present landscape.

DEC

ASSASSIN-FLIES OR ROBBER-FLIES (DIPTERA: ASILIDAE) OF YORKSHIRE, WITH NOTES ON RECORDS FROM OTHER AREAS OF NORTHERN ENGLAND

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There have been enormous advances worldwide in the study of Diptera since Skidmore (1966) published his account of the Asilidae of northern England and our knowledge of many families of flies in Yorkshire is such that the likelihood of discovering additional species in the county is very remote: the Asilidae is one such family.

Being essentially insects of warmer climates, the asilid fauna of Britain is extremely poor, there being a mere 27 British species compared with over 160 in France. Even in the vicinity of Calais, several species are found which do not occur in Britain. Fourteen asilids are known from Yorkshire, and the richest localities so far discovered in the county are Hatfield Moor and Rossington Bridge with eight and nine recorded species respectively, a total of eleven in all for the two sites.

The biology and ecology of almost all of our native species is fairly well known, thanks to the superb study by Melin (1923) on the Swedish asilid fauna. These aspects are discussed in Skidmore (1966), to which the reader is referred for further study. Suffice to say here that apart from Laphriinae, comprising three British species of *Laphria*, all other British asilids have terrestrial larvae which require sandy or very light soils. This fact renders many areas completely inimical to these flies, which is strikingly demonstrated by much richer faunas on sandy heaths compared with acidic peat bogs. Similarly, whilst some species occur on the Carboniferous limestone of the Yorkshire and Derbyshire dales, none will be found on the blanket bogs overlying the areas of Millstone Grit between.

Only one further British species is at all likely to be found in Yorkshire, namely *Dioctria oelandica* (Linnaeus). This is known from all the adjoining counties except Lincolnshire. It is an extremely conspicuous fly with deep metallic bluish or purplish wings and orange legs. It is most commonly encountered in calcareous woodlands, where it often hunts from hazel leaves on the edges of paths or clearings.

In the following review of species, the abbreviations etc. given in square brackets after the species name indicate the additions needed to update the table in Skidmore (1966).

ASILUS CRABRONIFORMIS LINNAEUS [ADD NR] There has been one further record of this species from northern England where it is now probably extinct. Mr K. G. Payne recalls seeing the species at Skipwith Common in the late 1940s. Drake (1991) notes that it has not been seen recently in East Anglia, where it was formerly widespread, and that it now appears to be declining south-eastwards. This very large fly is so spectacular that it could be recognised in the field by any observant countrylover. The only other known Yorkshire record is from Cloughton (anon. in Walsh & Rimington 1956). Excellent illustrations are given in Colyer and Hammond (1951) and Chinery (1986).

DYSMACHUS TRIGONUS (MEIGEN) [ADD NR AND CU] In Yorkshire, this species occurs on the sandy areas east of Doncaster, in the East Riding and along the coast. It is not however a common species in the county. (5 June to 17 July).

61 Allerthorpe, WJF; Hotham, 1.7.1971, RC; Kilnsea Warren, 17.7.1948, 16.6.1951, 21.6.1951, 15.7.1952, WDH & SS; Spurn, 19.6.1947, CAC.

62 Redcar, 11.6.1921, ?CAC: Sandburn Woods, 22.6.1929, WDH, (in coll. Manchester Museum).

63 Barnby Dun (Station Wood), 2.6.1988, JTB; Hatfield Lings, 6.1974, 20.5.1988, JTB; Lindholme Moraine, 7.1991, PS; Martin Beck Wood, 19.6.1920, CAC &

WJF; Rossington Bridge, 6.1987, PS.

Epitriptus cingulatus (Fabricius) [add WR, Dm, W, Nd] Records suggest that this is a very scarce fly in Yorkshire, but it is certainly overlooked. The only records to hand include two of the richest known sites for asilids in the county. (1 to 24 August).

61 Allerthorpe, WJF; Dryham, North Cave (44/87-32-), 11.7.1953, KGP.

63 Rossington Bridge, 12.8.1987, PS, 24.8.1987, 1.8.1988, JTB; Pot Hill (Sandall Beat Wood, Doncaster), 22.8.1987, JTB; ?Houghton Common, 1994, JDC.

[E. cowini Hobby Add Wales, Ireland.]

[Eutolmus rufibarbis (Meigen) has not been seen again in Lincolnshire, but it probably occurs in the southern part. It has been taken in numbers in the Brecklands of East Anglia in recent years (Drake, 1991).]

Machimus atricapillus (Fallén) [add WR, NR, Nd, Scotland] Although a typical species of calcareous uplands, this is a rather eurytopic asilid which has been taken by Peter Skidmore on sandy heath at Rossington Bridge, and in birch and oak forest at Tummel Bridge (Perthshire). Although fairly common in Derbyshire, it has not yet been recorded from the Yorkshire Dales. (2 July to 6 September).

61 Burdale (44/86-62-), 12.8.1990, AG; Dryham, 11.7.1953, KGP; Forden Bank N.R., 7.8.1971, JHF; North Grimston, 16.8.1975, JHF; Pocklington, 1.8.1936, CAC; 44/820557, 6.5.1957, DHS.

62 Ashberry Pasture (44/56-84-), 12.7.1992, 19.7.1992, AG; Cropton (44/75-89-), 15.9.1934, AS, det. AG; Elleron (44/78-90-), 17.7.1991, 29.7.1992, 14.8.1993, AG; Scar Wood (44/854849), 17.7.1985, MO; Ellerburn Bank, Thornton Dale, (44/85-85-), 1.8.1981, KGP, 23.8.1990, AG; Blaiskey Bank (44/62-88-), 14.7.1991, 28.7.1991, AG; Wombleton, 5.8.1940, ?CAC; Goathland (45/82-01-), 22.7.1979, WAE; Pickering (44/800850), 16.8.1986, GWK.

63 Anston Stones Wood, 8.1967, PS, 6.9.1975, 8.7.1979, WAE; Lindrick Common (43/54-82-), 2.7.1986, 15.7.1986, 21.7.1986, 15.9.1986, SJH; Little Stones (43/52-83-), 7.7.1982, SJH; Melton Wood, 8.1972, WGD; Roche Abbey (43/53-90-), 24.7.1986, 23.9.1986, SJH; Rossington Bridge, 8.1985, PS; Smeaton Leys, 31.7.1927, CAC.

64 Leeds district, WDH; Wood Hall, 14.7.1948, WDH, (in coll. Manchester Museum, probably the Leeds district record).

[*M. rusticus* (Meigen) may occur in southern Lincolnshire, as it has been taken in Northamptonshire (Drake, 1991).]

Neoitamus cyanurus (Loew) [add Li, D, Cu, Ireland] A characteristic species of broad-leaved woods, but sometimes occurring, perhaps as strays, in open country, or even in town or suburban gardens. It has been reported indoors, and even on board a ship in the Humber (Eades 1994), showing that it has considerable powers of dispersal. It has been found at 25 lowland Yorkshire 'sites' as far north as Hovingham, and is abundant on the heathland of Skipwith and Strensall Commons. It may prove to be a frequent species throughout lowland Yorkshire, and it is one of the few asilids recorded from Ireland. On 28.5.1994, Peter Skidmore found a teneral female with pupal case still attached, on *Mercurialis* under *Corylus* at Minigaff (Galloway). (30 May to 5 October). Yorkshire localities additional to those given in Skidmore (1966) are as follows.

61 Allerthorpe, 2.7.1945, WDH, 30.6.1984, RC; Skipwith Common (44/66-37-), 4.7.1991, 27.7.1991, 12.8.1991, AG.

62 Malton Road, York, (44/62-54-), 11.6.1943, AS, det. AG; Strensall Common (44/6—6—), 1942, RW, det. AG, 9.7.1991, 16.7.1991, 23.7.1991, AG; Sutton on Forest (44/58-64-), 28.6.1942, AS, det. AG.

63 Doncaster Museum (in foyer), 11.7.1983, PS; Hatfield Moor and Lindholme Moraine, (very common), 6-10.1991, PS; Hurst Wood, Rossington, 1.7.1973, PS; Pot Riding Wood, Cadeby, 6.7.1968, PS; Rossington Bridge, 6-7. 1985, PS, 30.5.1988, JTB.
64 Acomb, York (44/57-50-), 23.6.1943, AS, det. AG.

PHILONICUS ALBICEPS (MEIGEN) [delete D; add ER, Nd, IM] There are three known Yorkshire breeding sites for this coastal sand dune species. It was first taken in the county at Spurn by Dr R. H. Meade over a century ago, and was found to be still abundant on the sand dunes by Andrew Grayson on 15.7.1992 and 22.7.1992. Mr S. Foster recently reported that it still occurs on the small area of sand dunes at Bridlington. Mr C. Bentley reported that it was common at Coatham Sands, Redcar (45/571265), during 1991. (3 July to September).

[*PAMPONERUS GERMANICUS* (LINNAEUS) (add W)]

[*LAPHRIA MARGINATA* (LINNAEUS) No recent records from localities further north than Norfolk are given in Drake (1991), and even in the south the species appears to be scarcer than formerly.]

LEPTOGASTER CYLINDRICA (DEGEER) [add ER, WR, NR, D, W, Wales] In Yorkshire, this species is very widespread, frequenting rank grassy areas in lowlands. A very good illustration appears in Chinery (1986). (16 June to 1 August).
61 Derwent Ings, 1987-9, RC; Kilnsea Warren (several), 17.6.1947, WDH (in Nat. 1953, p. 161); Spurn, 22.7.1953, AB, & (54/41-15-), 15.7.1992, 22.7.1992, AG; (54/01-26-), 1945, DHS; (54/02-30-), 19.6.1957, DHS.
62 Ellerburn Bank, 16.6.1973, JHF; Strensall Common (44/65-61-), 23.6.1992, AG.
63 Smeaton Leas, 31.7.1937, CAC; (44/63-15-), 6.1977, PS; High Ellers Carr, 29.6.1977, PS; Bentley Common (Don Banks), 7.7.1976, PS; Potteric Carr, 14.7.1978, 5.7.1980, SF; Armthorpe, JTB; Old Denaby Tip (in large numbers), 4.7.1984, PS; Wilthorpe Marsh (44/33-09-), 1.7.1986, JDC; Carlton Marsh (44/37-09-), 19.6.1985, 13.7.1986, JDC; Thorne Moor, 1946 (Skidmore *et al.*, 1985); Rossington Bridge, 30.6.1986, 1.8.1988, JTB; Hatfield Moors, 6-7.1992, PS; Kirk Sandall Burgey Banks, 7.1992, CAH.
64 Acaster Ings (44/59-44-), 1.7.1950, KGP; Askham Bog (44/57-46-), 12.7.1944, AS, det. AG; Bolton Percy, 7.1942, WGB; Queen Mary's Dubb, Ripon, 17.6.1934, ?CAC.

L. GUTTIVENTRIS (DEGEER) [add Li, WR, NR] In Yorkshire, this species appears to favour rather better drained areas than the previous one, more often occurring in hilly areas. The national distribution also reflects this, as it extends to the north of Scotland. (17 June to 14 August).
61 Brantingham, 10.7.1971, RC.
62 Buttercrambe, 22.6.1935, WDH; Rievaulx (viewpoint) (44/56-85-), 17.6.1990, KGP.
63 Maltby Common, 9.7.1971, PS, 25.6.1972, JHF; Brocodale, 28.7.1968, RC; Howell Wood (44/43-09-), 14.8.1986, 4.7.1987, JDC; New Park Spring Wood (44/41-07-), 27.7,1990, JDC; Potteric Carr, 5.7.1977, SF; Hatfield Lings, 20.6.1974, JTB.
64 Ripon area, 7.1937, CM.

DIOCTRIA ATRICAPILLA MEIGEN [add D, SL] Virtually confined to lowland areas of Britain, this unmistakable black asilid is widespread in the inland lowland areas of Yorkshire. Although always localised, it often occurs in profusion amongst rank swards of *Arrhenatherum* and other coarse grasses, on heathland, along hedgerows and waysides, and

by waterside. The northernmost known site in Britain is at Howe Bridge, on the River Rye between Malton and Pickering, where it was found to be very abundant amongst tall grasses on the river bank by Andrew Grayson on 4.7.1993. Records from the Doncaster area are too numerous to enumerate here. This is the only British *Dioctria* with entirely black legs including coxae, and is well portrayed in Chinery (1986), (1 June to 17 July).

61 Allerthorpe, 12.6.1926, WJF, 30.6.1984, RC, (44/75-47-, 44/76-47-, 44/75-48-), 1.7.1984, WAE; (54/057380), 7.7.1955, DHS; (54/01-39-), 1.6.1950, AS, det. DHS; Derwent Ings, 1987-9, RC; North Duffield Carrs (44/697369), 5.6.1994, AG; Wheldrake Ings, (44/70-43-), 13.6.1994, AG; Thornton (44/741455), 12.6.1994, AG.

62 Warthill (44/6—5—), 12.6.1948, KGP; Strensall Common (44/6—6—), 2.7.1950, KGP, (44/64-60-, 44/64-61-), 2.6.1992, 9.6.1992, 30.6.1992, AG; Clifton Ings, (44/58-53-), 17.6.1943, JHE, det. AG; Howe Bridge (44/809761), 4.7.1993, AG.

63 Some 41 sites and over 50 records from Wilthorpe Marsh, Deffer Wood, Rainborough Park, Catcliffe Marsh and Anston Stones Wood, to the eastern Vice County boundary from Goole Moor to Kings Wood (Bawtry); dates from 8 June to 17 July.

64 Cock Beck, Stutton, Tadcaster (44/54-42-), 25.6.1950, KGP; Copmanthorpe (44/6—4—), 28.6.1950, KGP; Acaster Ings (44/59-44-), 1.7.1950, KGP; Acomb Brick Ponds, York, (44/58-49-), 23.6.1943, JHE, det. AG; Hook Moor, Aberford, WDH.

65 Boroughbridge, 1942 (ex. Gorham coll. teste CAC).

D. BAUMHAUERI MEIGEN [add D] This species appears to favour birchwoods in lowland sandy areas. Like *D. atricapilla*, it is principally a lowland species in Britain. (27 May to 14 August).

61 Allerthorpe Common, 19.6.1921, WJF, 21.6.1925, CAC, 2.7.1948, WDH, & 30.6.1984, RC; Bubwith, WJF; Barmby Moor, WJF; Dryham (44/87-32-), 1.7.1953, KGP; (44/940268,) 4.7.1965, DHS.

62 Strensall Common (44/64-61-), 9.7.1991, 16.7.1991, 14.8.1991, 27.5.1992, AG.

63 Cortonwood Colliery, 5.7.1988, JDC; Doncaster area – many records from Potteric Carr, Hatfield Moors, Hatfield Lings, Barnby Dun, Acomb Farm, Armthorpe, Sandall Beat N.R., Rossington Bridge, and Blaxton Common.

D. COTHURNATA MEIGEN [add WR, NR] Skidmore (1960) suggested that this fly should occur in northern England, and two Yorkshire records have now come to light. This is the only British *Dioctria* with a silvery thoracic marking restricted to the upper margin of the pleurae: all other British *Dioctria* have far more extensive and conspicuous inverted V or U shaped silvery thoracic markings on the pleurae. N.B. The female can be very easily mistaken for *D. rufipes* in the field; moreover, the key in Oldroyd (1969) will not work for female *D. cothurnata*, because the legs are almost wholly orange, as in *D. rufipes*.

62 Thornton Bank, 27.7.1980, JHF.

64 Acaster Ings (river bank) (44/59-44-), 4.7.1953, KGP.

D. LINEARIS (FABRICIUS) [add WR, D] This species is probably most often found in older woodlands in calcareous areas, and in such situations it can sometimes occur in quantity. The most northerly locality known for this species in Britain is at Temple Newsam. (5 June to 19 August).

63 Pot Riding Wood, Cadeby, 6.7.1968, PS (in Nat. 1969, p. 16), many dates since to 6.7.1986, PS, 29.6-27.7.1988, 23.6-19.7.1989, WAE; Shirley Pool, 6.1971, PS, 7.1971, SF, 22.6.1975, WAE; Rushy Moor, 1.7.1979, SF; Edlington Wood, 19.8.1971, PS; Cusworth Park, 13.7.1974, PS; (44/63-15-), 7.1977, PS; Hatfield Moor (eastern wooded edge, west of Lindholme Lake), 6.1992, PS; Old Spring Wood (43/53-81-), 14.8.1977, JEA and PGS; Howell Wood (44/43-09-),

15.7.1986, JDC; Hugset Wood (44/306070), 5.8.1985, JDC; Kiveton Park, (43/5—8—), WAE; Bretton Lakes (44/27-12-), 5.6.1993, JDC.

64 Avenue Wood, Temple Newsam, 7.1977, PS.

D. rufipes (Degeer) [add Wales] Generally regarded as our commonest asilid, this is certainly the most frequently recorded, and the most eurytopic. Yorkshire records are too numerous to enumerate here, as it has been recorded many times from all five vice-counties, and ranges from Bawtry to Ecclesfield, Almondbury (Huddersfield), Austwick, Richmond, Middleton in Teesdale (VC 65) and Spurn Point (VC 61). (21 May to 17 July).

Leptarthrus brevirostris (Meigen) [add ER, WR, D] This is our only asilid which favours upland areas and hence occurs widely in the more northern and western parts of Britain; indeed it is the only asilid known from the Western Isles of Scotland. The Yorkshire records also show this preference for more elevated areas. Like all asilids with terrestrial larvae however, it avoids acidic or heavy soils. It is fairly common in the Derbyshire Dales. (6 June to 21 August).

61 Kiplingcoates (44/41-93-), 3.7.1977, JHF, 18.7.1981, KGP; Admiral Plantation area (44/82-58-), 21.6.1980, WAE; Cat Babbleton (dewpond) (54/002745), 22.6.1985, RC & GWK; Potter Brompton, (wood edge on chalk) (44/9—7—), 21.6.1986, RC; Burdale (44/86-62-), 29.6.1991, AG.

62 Beck Hole, Goathland, 17.6.1968, HMR; Fylinghall, 26.6.1929, WJF, (in Walsh & Rimington, 1956); Ellerburn Bank (44/853847), 21.6.1986, GWK. 6.6.1990, AG; (44/79-63-), 3.7.1958, DHS; Ashberry Pasture (44/56-84-), 21.6.1992, 27.6.1992, AG.

63 Lindrick Common (43/54-82-), 16.6.1986, 3.7.1986, SJH.

64 Grassington 21.8.1920, RB (in Nat. 1921, p. 411); Hetchell Wood (44/3—4—), 1.7.1976, JHF (limestone grassland), 23.6.1986, RC.

Lasiopogon cinctus (Fabricius) [add WR, NR, W, Wales] In stark contrast to the previous species, this requires warm sandy heaths and sand dunes. Its most northerly known localities in eastern Britain are in the Scarborough district and at Pilmoor. (7 May to July).

61 Allerthorpe, many records from 7.5.1921 to 22.5.1929, WJF, 21.6.1925, CAC, 13.6.1994, AG; Skipwith, 24.6.1923, CAC; Seamer, 14.6.1943, anon.

62 Pilmoor, 16.5.1948, ?CAC; Strensall Common (44/65-62-), 10.6.1956, KGP (44/64-61-), 14.6.1994, AG; Scarborough (in Nat. 1957, p. 23); Staxton sandpits, (in Walsh & Rimington, 1956).

63 Hatfield Lings, 21.5.1975, 20.5.1988, JTB; Rossington Bridge, several dates in 5.1985, PS, 6.5.1988, JTB; Lindholme Moraine and Hatfield Moor N.R. (44/70-06-), 7.1991, PS; Pot Hill (Sandall Beat Wood, Doncaster), 12.5.1988, JTB; Barnby Dun (Station Wood), 2.6.1988, JTB. Lindrick Common (43/54-82-), 27.6.1986, DW.

Acknowledgments

Thanks are offered to all of the following who have submitted records: J. E. Addey, C. Bentley, J. T. Burn, J .D. Coldwell, R. Crossley, W. G. Dye, W. A. Ely, J. H. Flint, S. Foster, S. J. Hayhow, C. A. Howes, G. W. King, M. Oates, K. G. Payne, D. H. Smith, P. G. Stenton and D. Whiteley. The names of other collectors and determiners whose initials appear in the text are W. G. Bramley, A. Brindle, R. Butterfield, C. A. Cheetham, J. H. Elliott, W. J. Fordham, W. D. Hincks, C. Morley, H. M. Russell, S. Shaw, A. Smith and R. Wagstaffe.

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OBITUARY

S. MAURICE JACKSON
(1914-1995)

S. Maurice Jackson, the YNU Recorder for Lepidoptera since 1962, died on the 6th June 1995. One of the finest Yorkshire lepidopterists this century, he was wholly dedicated to his subject, of which his knowledge was outstanding. Born in Selby, the youngest of four children, he attended Drax Grammar School. During the Second World War he served in the Royal Signals and landed in Normandy shortly after D-day. He received the Imperial Service Medal in 1978.

Apart from travels throughout the country, preferably by rail, Maurice's observations and collecting were particularly concentrated on localities in the Vale of York. His fieldwork included beating for larvae and these he speedily identified; he was also very knowledgeable about larval foodplants. He was convinced that sites affected by the Industrial Revolution had never subsequently recovered the species diversity revealed by earlier records. He much welcomed having reports on or observations of any species, and he could always give a very informed and up to date reply to any question on macro-lepidoptera. Although it might at first have seemed nearly all his knowledge was concerned with his chosen subject, he was quite well informed on current affairs. He had an interest, together with some ability, in both classical and light music. Attendance at YNU field meetings was infrequent but he loyally supported the indoor ones. His very fine and comprehensive lepidoptera collection has now been presented to Doncaster Museum; to view this will be a most rewarding experience.

P. G. Tannett

THE MELITTID AND MEGACHILID BEES (HYMENOPTERA: MELITTIDAE AND MEGACHILIDAE) OF WATSONIAN YORKSHIRE

MICHAEL E. ARCHER
17 Elmfield Terrace, Malton Road, York YO3 0EH

Currently there are thirteen species of megachilid and one species of melittid bees present in Watsonian Yorkshire. The megachilid bees consist of the genera *Chelostoma* (Carpenter bee, one species), *Osmia* (Mason bees, three species), *Megachile* (Leaf-cutting bees, five species) and *Coelioxys* (Cuckoo bees, four species). This paper will provide a review of the Yorkshire species from a verified data-base including a history of the records.

The melittid bee, *Melitta leporina*, is a black coloured bee with brown hairs covering the head and thorax and narrow bands of brown hairs on the gastral terga. The apex of the gaster bears black hairs. *M. leporina* looks like many of the *Andrena* bees but differs in that the female lacks pollen-retaining hairs at the base of the hind legs and adjacent thoracic region. Pollen-retaining hairs are present on the hind tibiae. Distinctive features are the enlarged claw segment at the ends of the feet and the apical segment of the antennae is truncate, appearing as if the tip of the segment had been cut off.

The megachilid bees are black or metallic coloured bees covered by black, brown or red hair. A distinctive feature of the female is the presence of pollen-retaining hairs on the ventral side of the gaster rather than on the hind legs. The cuckoo bees do not have pollen-retaining hairs. The carpenter bee has a distinctive, narrow, elongated gaster. The female cuckoo bee can be distinguished by its acutely-pointed gaster apex, while the male cuckoo bee has a number of tooth-like projections at the end of the gaster. The Yorkshire mason bee species all show a blue or bronze metallic colouration. A distinctive feature of the leaf-cutter bee is the absence of a foot pad which normally lies between the two claws at the end of each leg.

Some of the megachilid bees are found in gardens collecting pollen or nectar from the flowers. The leaf-cutters cut out leaf segments from the roses while mason bees, such as *O. rufa*, inspect the surfaces of sun-exposed walls for crevices in which to nest.

There are no up-to-date keys for the melittid and megachilid bees but Willimer (1985) gives keys to the bee genera and Saunders (1896) gives keys to the species. Perkins (1925) gives keys to the species of *Megachile*.

LIFE CYCLES

In Watsonian Yorkshire, all the melittid and megachilid bee species pass through one generation a year, i.e. show univoltinism. Adults are mainly active from May until August, with most records from June and July and a few records from April and September (Table 6). *Chelostoma* and *Osmia* species tend to be active from May until July and *Megachile* later, from June until August.

Characteristics of the nesting sites are given in the species accounts. The vertical burrow of *Melitta leporina* has several lateral projecting cells made from soil so that the cells tend to be separated from each other. Each cell is lined with a waxy layer secreted by the female.

The cells of the megachilid nest are in contact with each other and usually the cells occur in rows separated from each other with a variety of collected materials. The cells of *Osmia* species are separated by a green mastic material made by chewing plant material, except for *O. rufa*, where the cells are separated by a paste made of soil and saliva. The cells of *Chelostoma florisomne* also are separated by a paste made of soil and saliva. The cells of *Megachile* species are made from circular and oval cut pieces of leaves, often cut from roses. The species of *Coelioxys* are cleptoparasites, usually on *Megachile* species but also on *Anthophora* species.

The cells of melittid and megachilid bees are mass provisioned with pollen and nectar. An egg is laid on the pollen-nectar ball, on which the hatched larva feeds in a closed cell. The female of *Coelioxys* uses its pointed gaster to penetrate its host cell so that its egg is laid on the cell wall or near the egg of its host. On hatching, the larva of *Coelioxys* destroys the host's egg or young larva, after which it eats the host's pollen-nectar mass. Species of *Chelostoma* and *Megachile* overwinter in the mature larval stage, while species of *Osmia* overwinter in the cells as adults.

Williams (1972) and O'Toole (1989) give further biological information besides showing how the aerial nesting species can be reared in trap-nests.

Historical Account

Work on the Yorkshire melittid and megachilid bees started with Smith (1852, 1855, 1891) who discovered seven species: *Chelostoma leporina, Osmia rufa* (as *O. bicornis), Megachile centuncularis, M. circumcincta, Coelioxys quadridentata, C. rufescens* and *C. vectis. C. vectis* has never been found again and since this species is a cleptoparasite on *Megachile maritima*, which has never been found in Yorkshire, the identity of *C. vectis* must be considered a misidentification. Perkins in Fordham (1933) also regarded *C. vectis* (as *C. trigonus*) a misidentification.

Roebuck (1878) reported the species of Smith and added six species: *Anthidium manicatum, Osmia caerulescens* (as *O. aenea), O. leaiana* (as *O. fulviventris), O. aurulenta, Megachile willughbiella* and *Coelioxys elongata*. The records of these six species were based upon marks made in a copy of Smith (1855) by Smith himself, of species found within a few miles of Woolley, Wakefield. There has been doubt as to whether these records were based on specimens or on what might be found (Butterfield & Fordham, 1930). As such these Smith manuscript records are not usually accepted unless verified by further records. Since Roebuck (1878), two of the six species, *A. manicatum* and *O. aurulenta*, have never been verified.

Roebuck (1907) provided additional records for *M. willughbiella* and *C. elongata* and added *C. mandibularis* which appears to be another Smith manuscript record. *C. mandibularis* has never been verified.

Butterfield & Fordham (1932) provided additional records for *O. caerulescens* and *0. leaiana* and added *M. ligniseca* and *C. inermis*.

This paper adds *Melitta leporina* and *M. versicolor*.

The Record Data Base

The 14 species are represented by 425 records from 131 localities in 123 1km squares or 63 10km squares (Table 1). A record is based upon a specimen where the data varies in one of the following: name, sex, locality and day-date of capture or observation. The author has seen the specimens of 314 (74%) of the records.

Watsonian Yorkshire may be considered to include, at least in part, 195 10km squares. Map 1 shows the number of records, and Map 2 the number of species, found in each 10km square. Records are known from 32% of the 10km squares. No records are known from Craven, Cleveland and VC65 which includes a part of the Pennines and the northern part of the Vale of York. Few records are known from the North York Moors, northern part of the Yorkshire Wolds and Holderness, except for Spurn.

Using the number of records per species as a measure of abundance and the number of 1km squares in which each species occurs as a measure of range for the megachilid species, a plot of abundance versus range can be made (Fig. 1). The correlation coefficient of 0.94 is a statistically highly significant relationship ($p<0.001$) indicating that as the range of a species increases so does its abundance. The regression equation can be expressed as: Abundance = 1.53 Range + 5.12.

The top twelve localities with either ten or more records or five or more species are given in Table 2. The sandy localities of Allerthorpe, Strensall and Skipwith Commons with Spurn have proved to be important localities, as have the wooded clay sites of

TABLE 1

Records and distributional units of the Melittidae and Megachilidae found in Watsonian Yorkshire to March 1995.

Species	No. records	No. localities	No. 1km	No. 10km	No. VCs
Melitta leporina	6	6	6	4	2
Chelostoma florisomne	31	15	16	12	3
Osmia caerulescens	29	14	14	11	4
Osmia leaiana	20	18	18	15	4
Osmia rufa	89	61	59	38	4
Megachile centuncularis	40	30	29	24	4
Megachile circumcincta	42	20	20	17	4
Megachile ligniseca	11	5	5	5	3
Megachile versicolor	26	9	9	9	3
Megachile willughbiella	71	37	36	27	4
Coelioxys elongata	42	14	13	12	4
Coelioxys inermis	6	6	6	6	3
Coelioxys quadridentata	8	4	4	4	2
Coelioxys rufescens	4	4	4	4	2
Total	425	131	123	63	4

Duncombe Park and Lindrick Common. The suburban garden site at Heworth, York and the park at Roundhay, Leeds, indicate that strongly man-controlled habitats can still be important.

Table 3 shows the number of records known from the ninteenth century and each decade of the twentieth century. Few records have survived from the nineteenth century (about 3%

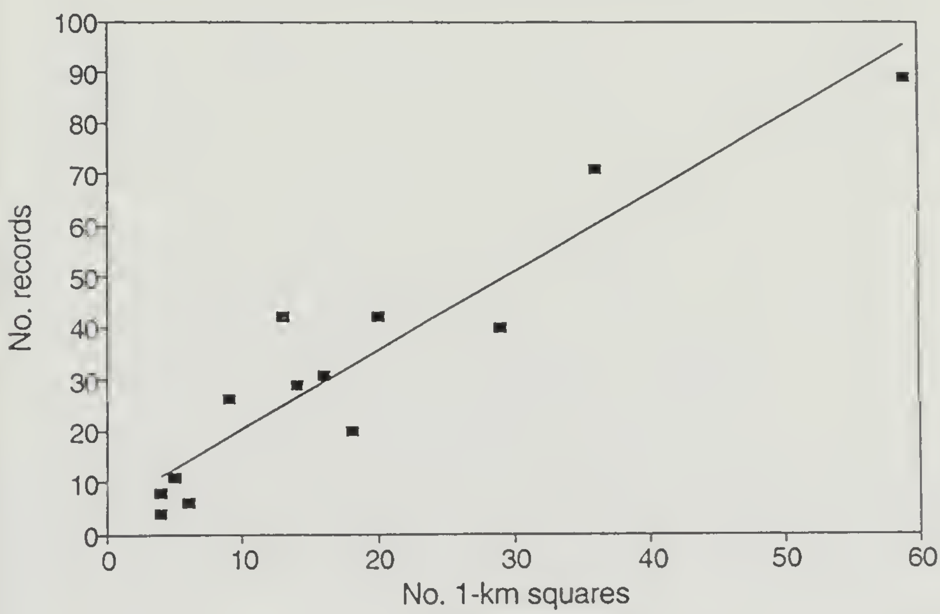


FIGURE 1

The abundance versus range of megachilid bees.

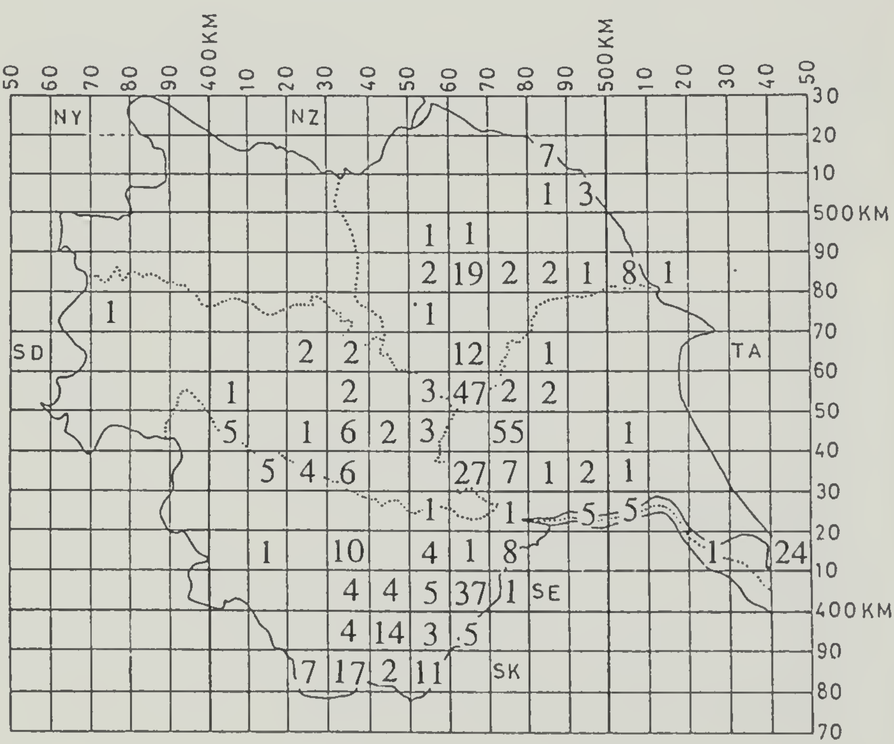
TABLE 2

The localities in Watsonian Yorkshire with either ten or more records or five or more species of Melittidae nad Megachilidae.

Locality	No. species	No. records
Allerthorpe Common	10	47
Heworth, York	6	40
Spurn	6	24
Skipwith Common	5	20
Duncombe Park	4	18
Strensall Common	6	12
Woolley (F. Smith)	10	10
Hatfield Lings	5	9
Thorne Moor	5	7
Scarborough	5	6
Whitby	5	6

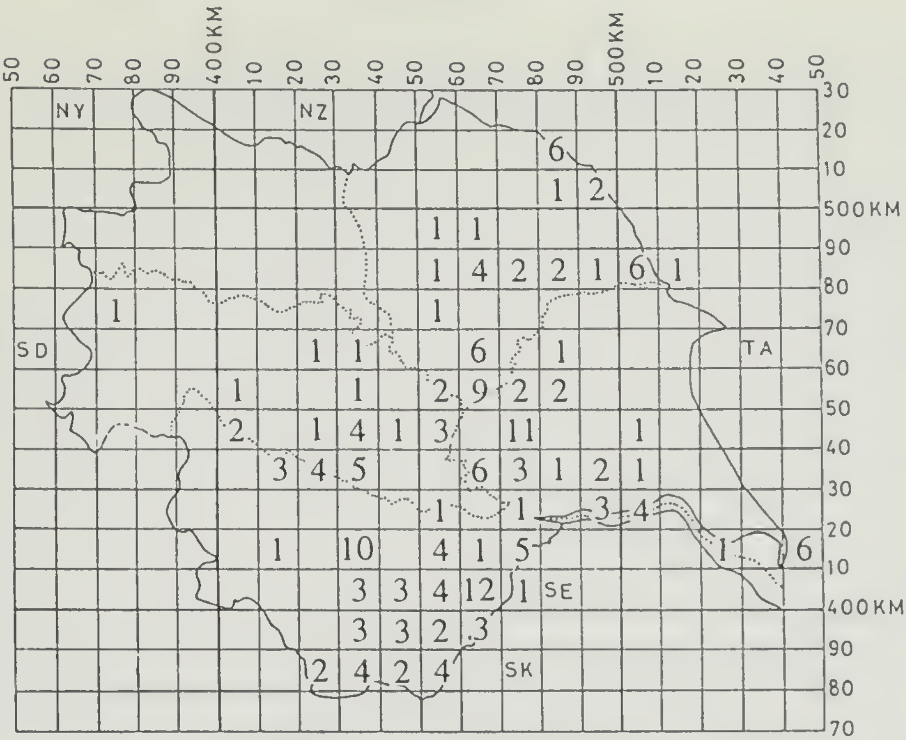
of the dated records). Most records are from the 1970s and 1980s although there is an earlier peak of records during the 1920s. The 1920 collectors were W. J. Fordham and J. Wood working at Allerthorpe Common, R. Butterfield at various localities, D. W. Bevan at Scarborough, A. E. Bradley at Roundhay Park, Leeds, and F. Rhodes at Bradford.

Table 4 shows the twelve most important collectors of records. Only F. Smith emerges



Map 1

Number of records from each 10km square.



Map 2
Number of species from each 10km square.

TABLE 3
The time source of records of Melittidae and Megachilidae from Watsonian Yorkshire.

	No. records
Previous to 1900	12
1900s	6
1910s	19
1920s	43
1930s	15
1940s	20
1950s	19
1960s	15
1970s	115
1980s	112
1990s	42

from the nineteenth century. A heyday of collecting by R. Butterfield, W. J. Forham and J. Wood existed in the early part of the twentieth century, followed by only a single collector of note, W. D. Hincks, in the middle of the twentieth century. The late twentieth century has shown a renewed interest with seven important collectors (Table 4).

Table 5 shows the sources of records with 14.1% from published and unpublished literature, 28.7% from museum collections, and 57.2% from private collections or sighted records. The collections at Manchester, Keighley, Rotherham and Sheffield museums have

TABLE 4
The names and years of activity of the collectors of Melittidae and Megachildae in Watsonian Yorkshire with ten or more records

	No. records	Years of activity
Archer, M. E.	160	1957-1994
Burn, J. T.	31	1970-1983
Hincks, W. D.	24	1942-1952
Fordham, W. J.*	23	1915-1938
Butterfield, R.*	18	1907-1927
Ely, W. A.	14	1974-1989
Shaw, R.	14	1990-1993
Smith, D. H.	13	1948-1969
Flint, J. H.	10	1965-1981
Riley, T. H.	10	1973-1984
Smith, F.	10	1852-1877
Wood, J.	10	1927-1935

* Some of the records of these collectors are undated

TABLE 5
The sources of records of Melittidae and Megachilidae from Watsonian Yorkshire

	No. records
Doncaster Museum	11
Keighley Museum	25
Leeds Museum	5
Manchester Museum	28
Rotherham Museum	21
Scarborough Museum	11
Sheffield Museum	17
York Museum	4
Private collections	238
Sighted records	5
Literature records	60

been particularly important sources of records. I acknowledge my thanks to the curators of the eight museums and the 39 persons with private collections who have been the sources of records.

Species Accounts
The information for each species is given in the following order: Biological name; Map number if given, or if no map is given the 10km squares are given (B = records before 1950, A = records 1950 onwards); Status (Archer, 1993); Seasonal appearance of adults (Table 6); Relative abundance of each sex (Table 7); Habitat, which is not given for the cleptoparasites; Nesting site characteristics, which are not given for the cleptoparasites; Flowers visited; Cleptoparasites or host(s) of cleptoparasites; National status (Archer, 1995), and national seasonal appearance of adults.

TABLE 6
The seasonal appearance of adults of Melittidae and Megachilidae in Watsonian Yorkshire

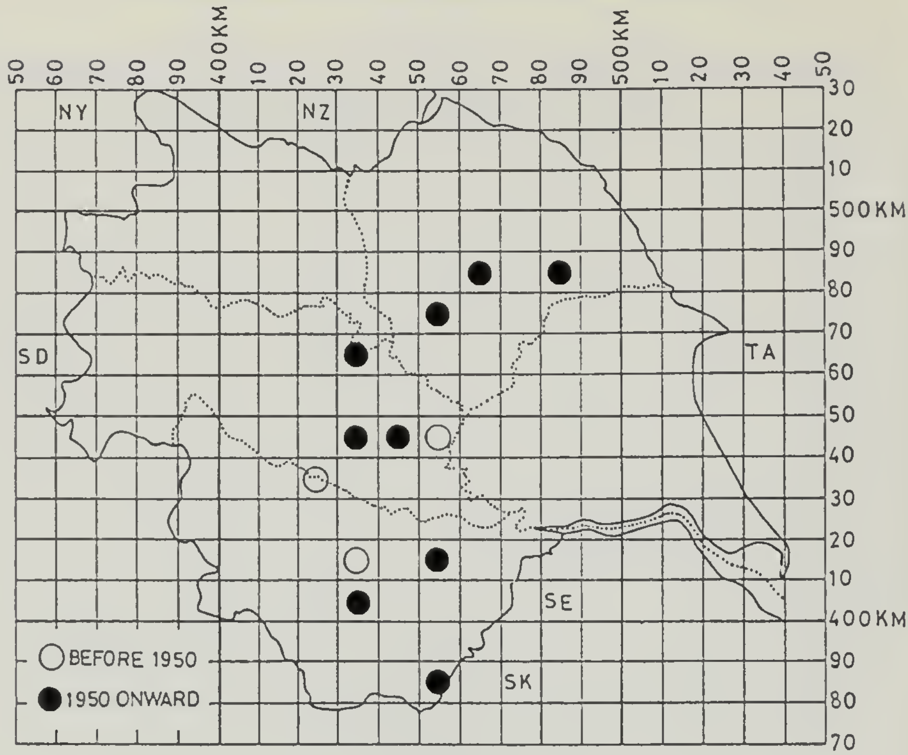
	April	May	June	July	August	Sept.
Melitta leporina		4	2			
Chelostoma florisomne		5	21	4		
Osmia caerulescens		10	12	5		
O. leaiana		1	10	6		
O. rufa	6	40	30	2		
Megachile centuncularis			8	20	4	
M. circumcincta			27	8	3	
M. ligniseca			1	2	5	2
M. willughbiella			14	37	14	1
Coelioxys elongata			15	12	9	
C. inermis			1	4		
C. quadridentata			6	1		
C. rufescens		1	0	2		

TABLE 7
The number of records of the sexes of Melittidae and Megachilidae
from Watsonian Yorkshire

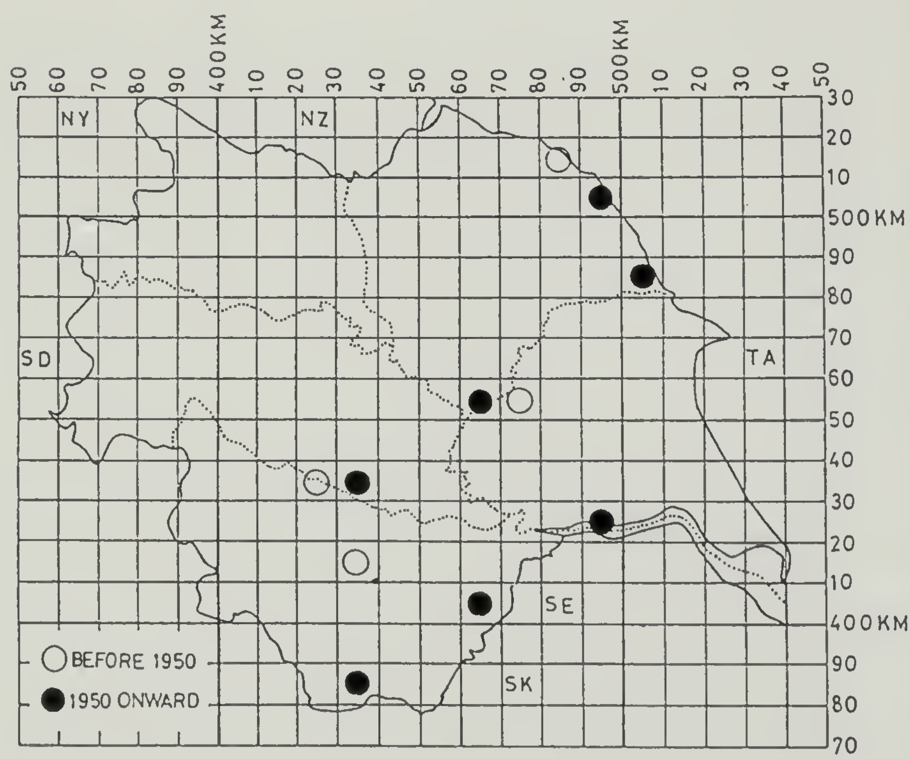
	Female	Male	Unknown
Melitta leporina	1	2	3
Chelostoma florisomne	12	15	4
Osmia caerulescens	15	12	2
O. leaiana	8	4	8
O. rufa	29	40	20
Megachile centuncularis	17	17	6
M. circumcincta	17	15	10
M. ligniseca	7	2	2
M. versicolor	10	14	2
M. willughbiella	41	23	7
Coelioxys elongata	21	9	12
C. inermis	3	1	2
C. quadridentata	3	1	4
C. rufescens	0	2	2

Melitta leporina (Panzer, 1799)
Rare; SE50A, SE60A, SK69A, TA04A; July until August; Sandy soils; Subterranean nester; Legumes, particularly clover and melilot; *Nomada flavopicta* (Kirby, 1802); Nationally restricted, June until August.

Chelostoma florisomne (Linnaeus, 1758) (Map 3)
Occasional; Mid-May until late July but mainly during June; sexes more-or-less equally found; Particularly associated with wooded areas on limestone or chalk; Aerial nester in dead wood and hollow stems of straws; Visits buttercups; *Sapyga* sp. and *Trichrysis cyanea* (Linnaeus, 1758); Nationally universal, April until August.



Map 3
Chelostoma florisomne (Linnaeus, 1758).



Map 4
Osmia caerulescens (Linnaeus, 1758).

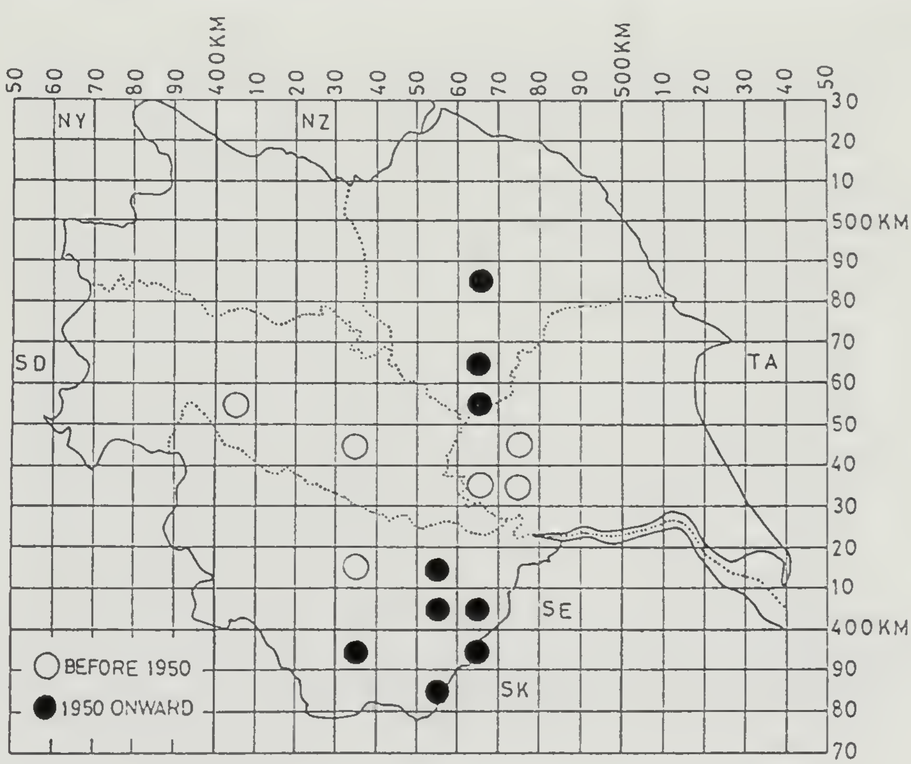
Osmia caerulescens (Linnaeus, 1758) (Map 4)
Occasional; Mid-May until late July but mainly during May and June; sexes more-or-less equally found; Often found in gardens; Aerial nester in dead wood and holes in walls; Visits variety of flowers including legumes and labiates; *Sapyga* sp.; Nationally universal, April until August.

Osmia leaiana (Kirby, 1802) (Map 5)
Frequent; Late May until late July but mainly during June and July; Females more frequently found but sample size small; Variety of wooded habitats; Aerial nester in dead wood, holes in walls and earthen banks; Visits variety of flowers including thistles and ragwort; *Sapyga* sp.; Nationally widespread, May until September.

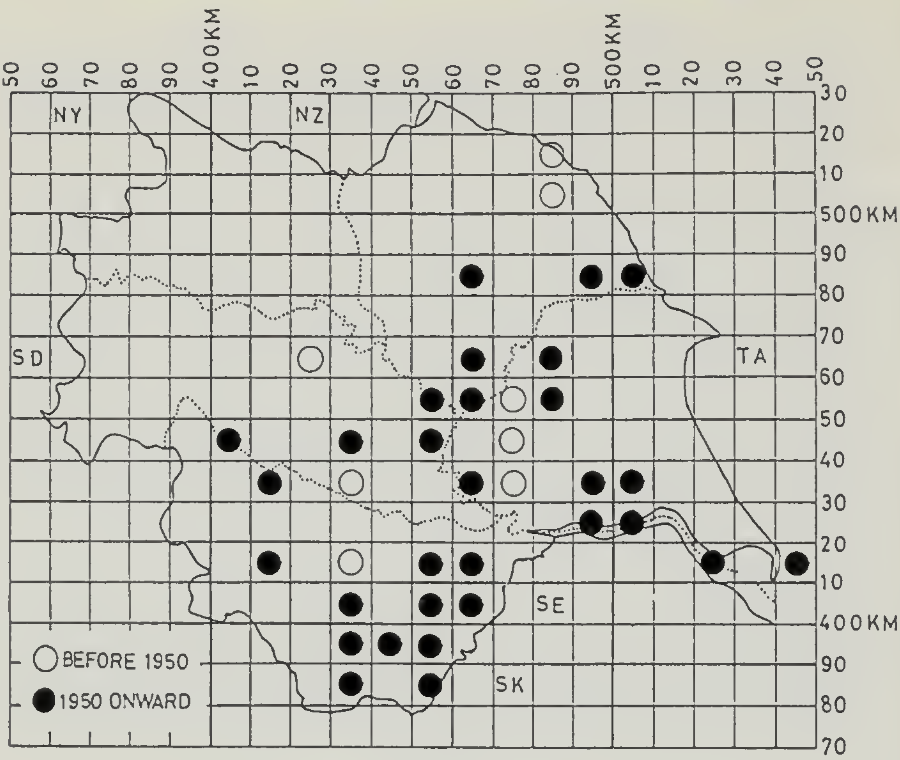
Osmia rufa (Linnaeus, 1758) (Map 6)
Common; Late April until early July but mainly during May and June; Males more frequently found; Often found in gardens; Aerial nester in crevices, e.g. dead wood and holes in walls; Visits variety of flowers including brambles and clover; Nationally universal, March until July.

Meachile centuncularis (Linnaeus, 1758) (Map 7)
Frequent; Early June until mid-August but mainly during July; Sexes equally found; Often found in gardens; Aerial nester in crevices in dead wood and old walls but also in the ground; Visits variety of flowers including thistles, legumes and brambles; *Coelioxys inermis* and *C. elongata*; Nationally universal, June until August.

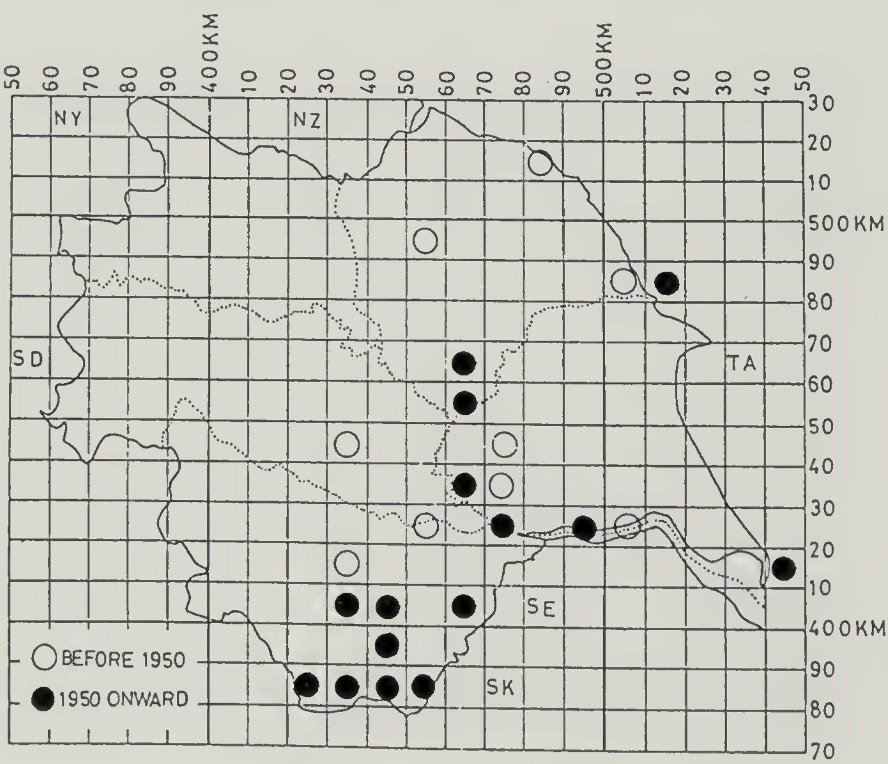
Megachile circumcincta (Kirby, 1802) (Map 8)
Frequent; Early June until mid-August but mainly during June; Sexes more-or-less equally



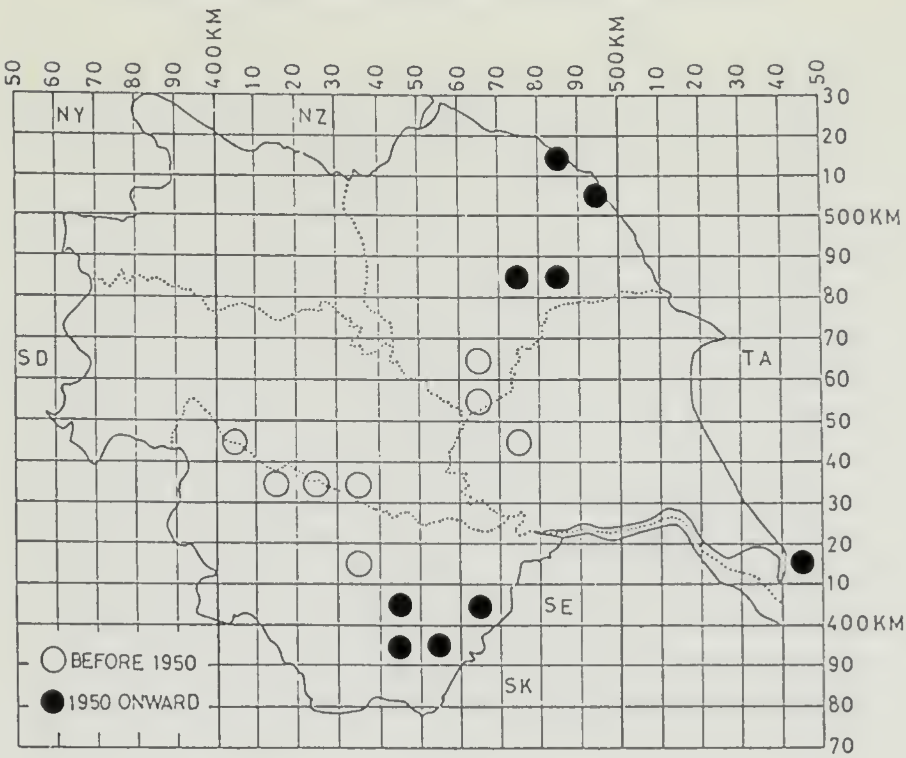
Map 5
Osmia leaiana (Kirby, 1802).



Map 6
Osmia rufa (Linnaeus, 1758).



Map 7
Megachile centuncularis (Linnaeus, 1758).



Map 8
Megachile circumcincta (Kirby, 1802).

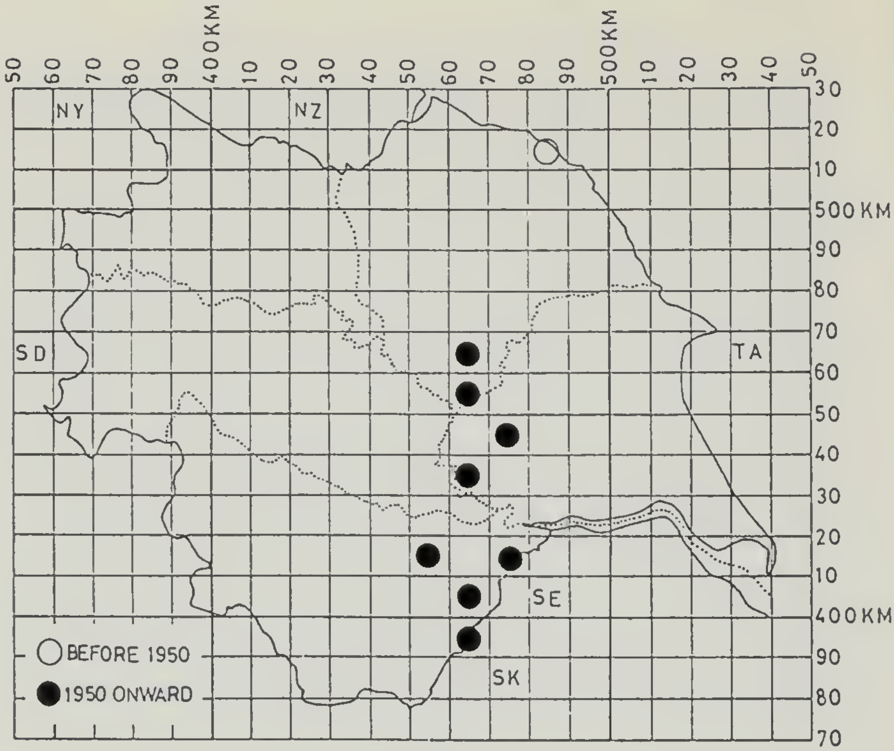
found; Particularly associated with sandy soils; Subterranean nester with burrows branching downwards; Visits variety of flowers including legumes; *Coelioxys elongata, C. rufescens* and *C. quadridentata*; Nationally universal, May until August.

Meachile ligniseca (Kirby, 1802)
Rare; SE50A, SE63A, SE71A, SE74B, TA08B; June until mid-September but mainly during August; Females more frequently found but sample size small; Wooded areas away from human habitation; Aerial nester in dead wood and other crevices; Visits variety of flowers including thistles; *Coelioxys elongata*; Nationally widespread, June until September.

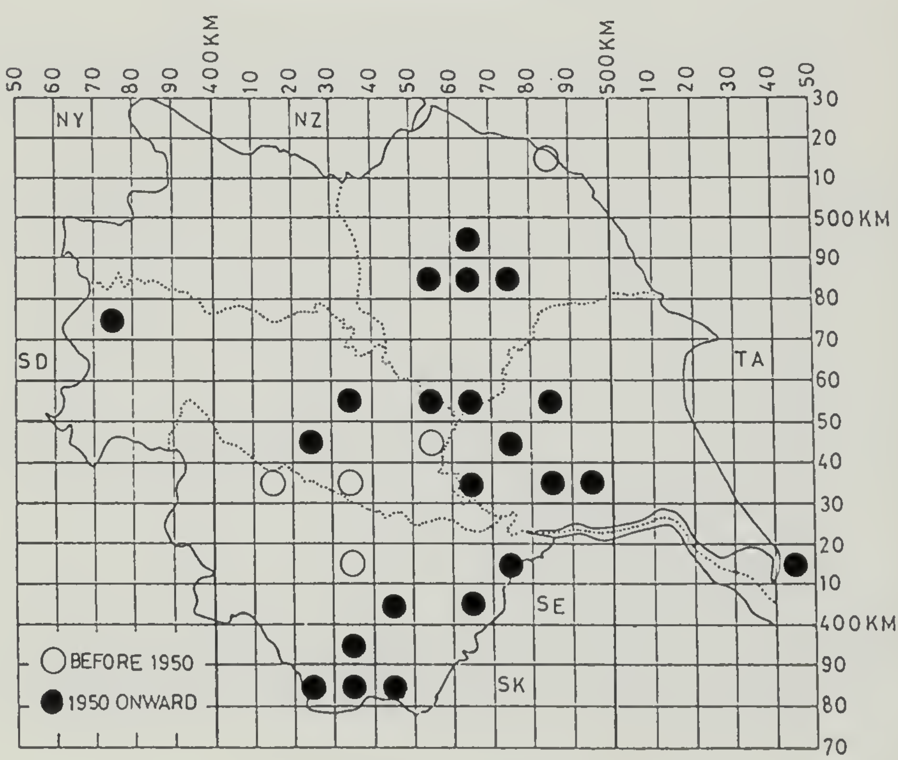
Megachile versicolor (Smith, 1844) (Map 9)
Occasional; Early June until early September but mainly during August; Sexes more-or-less equally found; Wooded areas away from human habitations; Aerial nester in dead wood; Visits variety of flowers including thistles and legumes; *Coelioxys inermis*; Nationally widespread, May until September.

Megachile willughbiella (Kirby, 1802) (Map 10)
Frequent; Early June until early September but mainly during July; Females more frequently found; Often found in gardens; Aerial nester in dead wood, holes in walls but also crevices in the ground; Visits variety of flowers including legumes and campanulas; *Coelioxys elongata, C. rufescens* and *C. quadridentata*; Nationally universal, June until September.

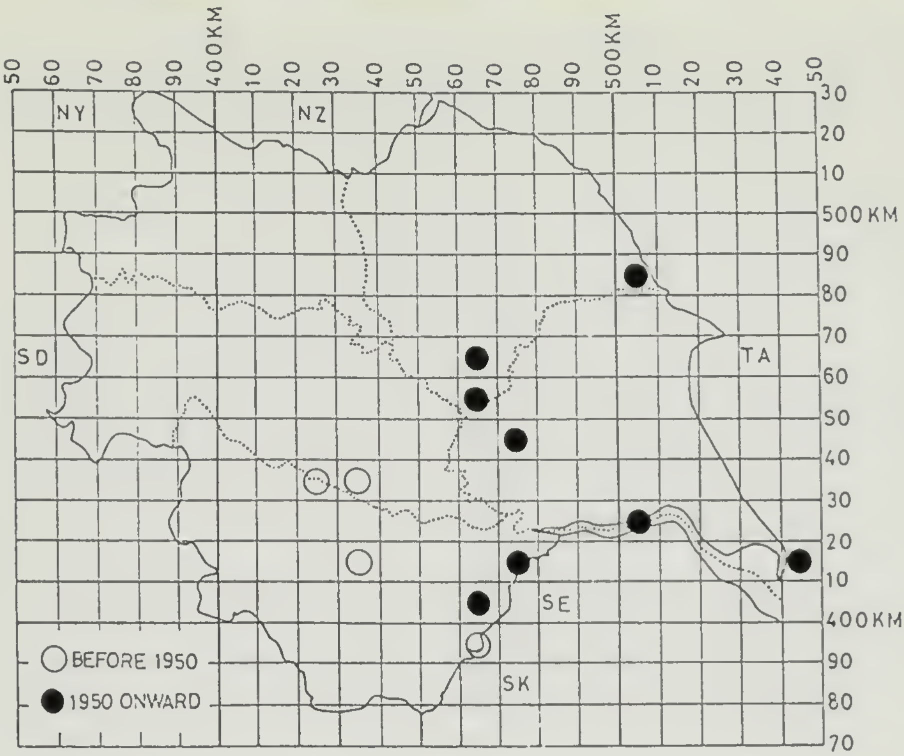
Coelioxys elonata Lepeletier, 1841 (Map 11)
Occasional; Late June until mid-August; Females more frequently found; Visits variety of



Map 9
Megachile versicolor (Smith, 1844).



Map 10
Megachile willughbiella (Kirby, 1802).



Map 11
Coelioxys elongata Lepeletier, 1841.

›wers including legumes, field scabious and fleabane; On *Megachile centuncularis*, *M. rcumcincta*, *M. ligniseca* and *M. willughbiella*; Nationally universal, June until August.

›elioxys inermis (Kirby, 1802)
ıre; SE60A, SE65A, SE70A, SE71A, SE74B, TA08B; Late June until mid-July; Visits ıriety of flowers including legumes and field scabious; On *M. circumcincta* and *M. rsicolor*; Nationally widespread, June until September.

›elioxys quadridentata (Linnaeus, 1758)
ıre; SE31B, SE60A, SE74B, TA41A; Mid-June until late July; Visits flowers of legumes, aths and knapweed; On *Anthophora* sp., *Megachile circumcincta* and *M. willughbiella*; ationally rare (RDB3), June until August.

›elioxys rufescens Lepeletier & Serville, 1825
ıre; SE31B, SE60A, SE74B, TA02B; May until July; Visits flowers of legumes, abious, bramble & thistles; On *Anthophora* sp. and *Megachile circumcincta*: Nationally despread, May until August.

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BOOK REVIEWS

Provisional Atlas of the Lacewings and Allied Insects (Neuroptera, Megaloptera, Raphidioptera and Mecoptera) of Britain and Ireland by **Colin W. Plant.** Pp. 203, with distribution maps. 1994. Biological Records Centre, Abbots Ripton, Huntingdon. £ 6.50.

This useful book is an essential provisional atlas on lacewings and allied insects of Britain and Ireland. The lacewing recording scheme is explained and example recording cards are illustrated. Key identification works are listed, together with notes on record validation and the author's address for identification of specimens. A synonymic checklist is included which will prove invaluable in updating many collections and record databases. Individual species distribution maps are accompanied by useful notes on distribution, status, habitat, collecting and seasonal occurrence. The book concludes with an assessment of species status in relation to the Red Data Book with proposed changes of status for some species. Annexes cover an extensive bibliography of reference works, a list of museum collections examined, and literature researched.

SF

Birds of Brazil by **Helmut Sick**, translated by **William Belton**. Pp. 703, plus 46 plates. Princeton University Press, 1993. £70.00.

This book, originally published in Portuguese as *Ornithologia Brasileira* in 1985 by the University of Brasilia Press, provides detailed information on one of the world's richest avifaunas. It also presents the historic evolution of ornithology in South America's largest country, with information on the various facts that have influenced it. Special chapters on 'Biogeography and speciation' and 'An account of Brazilian fossil birds' have been prepared by Jurgen Haffer and Herculano Alvarenga respectively, while Sick, who died in Rio de Janciro in 1991 at the age of 86, provides an interesting account of bird vocalisation, one of his areas of interest. In *Birds of Brazil* the reader will find

omprehensive descriptions of the 1,653 species found in widely different habitats across ie country, as well as information on the problems of bird conservation, relating these ith the nation's geography. The well prepared plates give an accurate view of many of iese species, which are some of the world's most fascinating birds. Strongly ecommended to those interested in birds and their behaviour.

WLF

CONTRIBUTORS

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The Naturalist

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Published by the Yorkshire Naturalists' Union

Editor **M. R. D. Seaward,** MSc, PhD, DSc, FLS, The University, Bradford BD7 1DP

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ʼHE BIOLOGY AND ECOLOGY OF THE THISTLE BROOMRAPE, *OROBANCHE RETICULATA* WALLR.

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Department of Environmental Science, University of Bradford, Bradford, BD7 1DP

TRODUCTION

robanche reticulata Wallr., commonly called the thistle broomrape, belongs to the *robanchaceae* L. As with all other broomrapes it is holo-parasitic or heterotrophic and us relies on its usual hosts, the thistles (*Cirsium* and *Carduus*), for all organic food. The stribution of *O. reticulata* is perhaps the most curious of all the British species of *obanche*, being confined to Yorkshire where it occurs mainly over magnesian limestone umsey & Jury, 1991; Foley, 1993). In Europe it is present from Spain in the west to stern Russia in the east, and can be found as far north as Estonia and Sweden (Bonnier Layens, 1968; Tutin *et al.*, 1972; Kreutz, 1995). Given the abundance of its preferred st plant, *Cirsium arvense* (L.) Scop., why is the parasite so rare in the British Isles? In der to help answer this question an autecological investigation was carried out in the mmer of 1995 with the assistance of English Nature.

As with many other species of *Orobanche*, *O. reticulata* has been dogged by mis-entifications (Foley, 1993; Abbot 1994), and earlier collections of *O. reticulata* in ensleydale were mistakenly identified as *O. minor* Smith or *O. major* L. (Slater, 1882; es, 1888; Pugsley, 1940). *O. reticulata* was first discovered as a British species in harfedale by Craven in 1907 (Druce, 1909). The plants of *O. reticulata* from Brecon ributed to *O. reticulata* are now regarded as that of *O. loricata* Reichenb. (Graham, 57). Most British *O. reticulata* has been identified as var. *pallidiflora* (Wimmer & Grab.) ck: some authors have given it specific rank, e.g. Kreutz (1995), but it is considered by msey and Jury (1991) to be conspecific.

STRIBUTION AND HABITATS

reticulata has had at least 15 separate populations within the last 4 years in a total of six x 10km grid squares. The populations are found in a wide variety of habitats, including pasture, edges of arable fields, abandoned quarries, woods and roadside verges, but a ge proportion are on the banks or within the flood-plain of the rivers Wharfe and Ure. l the sites in the British Isles are at a relatively low altitude (10 to 125m a.s.l.) compared some of the continental sites where it is found in the sub-alpine belt as well as on the ins (Kreutz, 1995) and has been seen at an altitude of at least 500m in the German Tyrol aeupler & Schönfelder, 1988). The British occurrences are on the whole on relatively flat es, but where it does occur on sloping ground (maximum angle 25°) nearly all have a sterly aspect.

OLOGY AND SOILS

total of 19 soil samples were taken in June and July 1995 from 13 of the sites where *O. iculata* has been seen in the last 4 years. A full textural analysis and some chemical alyses were carried out on these soils following the methods of Allen *et al.* (1974). hough many *O. reticulata* sites are on the Magnesian limestone in Yorkshire it does also cur on chalk and glacial alluvium. Most of the soils are either river alluviums, rendzinas calcareous brown earths: the soils consequently have a high pH (Table 1). At the sites ere the soil pH was below 7.4 the plant had been ploughed up or was not seen when the ls were collected. The restriction of the plant to soils with a particular pH is curious ce parasites do not depend directly on the soil for their nutrition. However, the ceptibility of the host plant to infection by the broomrape may be affected by soil aracteristics.

The proportion of sand in all the samples was very high and they were all classified as

TABLE 1

The pH, total nitrogen (% dry wt), plant-available phosphate and exchangeable potassium and calcium (ppm) of 19 soil samples taken from 13 *O. reticulata* populations in Yorkshire.

Soil Characteristic	range	mean ± S.E.
pH	4.9 – 8.0	7.4±0.2
total nitrogen (% dry wt.)	0.04 – 0.79	0.30 ± 0.04
plant-available phosphate (ppm)	3.5 – 28.1	11.9 ± 1.6
exchangeable potassium (ppm)	0.15 –1.82	0.52 ± 0.10
exchangeable calcium (ppm)	30 – 300	128 ± 12

either a pure sand, loamy sand or sandy loam using the British Standards system of soil classification (Fig. 1). At first examination this feature might appear to be important for the washing in of the tiny seeds into the soil and subsequent establishment onto its host roots, but the seeds are the same size as medium sand grains.

The soils appear to be reasonably fertile as total nitrogen and plant-available phosphate concentrations are relatively high for non-agricultural soils (Table 1). The concentrations of exchangeable calcium are low (Table 1) considering the pH and parent material, but this might be due to a low cation exchange capacity which is normally associated with sandy soils. This would also explain the exceedingly low plant-available potassium concentrations and this element may well be limiting plant production in these sites (Table 1).

Vegetation

The vegetation types seen at the sites fall into two main categories. The commonest vegetation type associated with *O. reticulata* is *Arrhenatherum elatioris* grassland

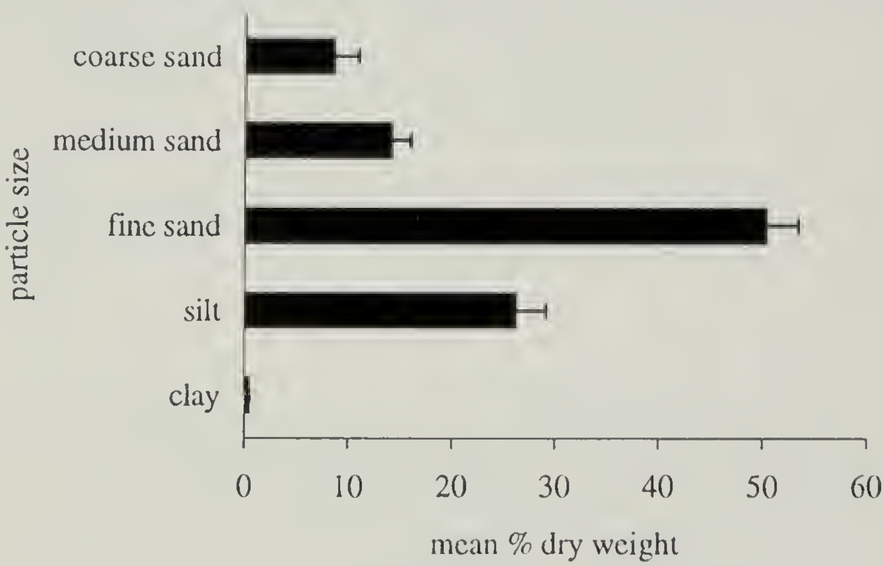

FIGURE 1

The particle size distribution of 19 soils collected from 15 *Orobanche reticulata* Wallr. sites from Yorkshire. Diameters of the particle size classes are as follows: coarse sand = 0.6-2.0mm, medium sand = 0.2-0.6mm, fine sand = 0.06-0.2mm, silt = 2-60μm and clay <2μm.

National Vegetation Classification (NVC) mesotrophic grassland 1 (MG1). This is one of the commonest grasslands in Britain, typical of road and motorway verges with a rank, relatively species-poor community dominated by *Arrhenatherum elatius*, *Dactylis glomerata* and *Holcus lanatus* (Rodwell, 1992); also common in this community are large umbellifers (especially *Heracleum sphondylium*), *Cirsium arvense* and *Urtica dioica* with *Centaurea nigra* if the soil is base rich. At one roadside site the greater species diversity probably represents the *Centaurea nigra* sub-community (NVC MG1e), distinguished by species such as *Hypericum hirsutum*, *Plantago lanceolata*, *Achillea millefolium*, *Primula veris* and *Centaurea nigra*. The *Urtica dioica* sub-community was found at the River Ure sites though *O. reticulata* was never found in direct association with *U. dioica*.

The second vegetation type that *O. reticulata* is associated with can be seen at the woodland sites. These were classified as *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland (NVC W8). However, management at both sites has resulted in a different community and where *O. reticulata* is found it is more akin to a *Rubus fruticosus-Holcus lanatus* underscrub community (NVC W24). One plot gave a good match with the *Cirsium arvense-C. vulgare* sub-community (NVC W24a) indicated by the presence of *Glechoma hederacea* L., *Epilobium hirsutum* L., *Cirsium* spp. and *Sambucus nigra* L. (Rodwell, 1991). These sites are undergoing succession, having been clear-felled or coppiced and are therefore difficult to classify.

In Europe the plant is found in a wide range of habitats including alpine grassland, ruderal habitats, stony and wet habitats on calcareous and nutrient-rich, loamy soil (Kreutz, 1995).

BIOLOGY

O. reticulata has been reported as parasitising a wide range of thistles in the British Isles, including *Cirsium arvense*, *C. vulgare*, *C. eriophorum*, *C. palustre* and *Carduus acanthoides* (Rumsey & Jury, 1991; Foley, 1993). In Switzerland it has been reported to parasitise *C. defloratus*, *C. personata*, *Cirsium oleraceus* and *Scabiosa columbaria* as well as *C. arvense* (Sching & Keller, 1909), but these probably refer to what is regarded by some as a different species (Kreutz, 1995). Kreutz (1995) does, however report *O. pallidiflora* as having *C. arvense*, *C. eriophorum*, *C. vulgare*, *C. oleraceum*, *Carduus acanthoides* and *C. crispus* as hosts, whilst *O. reticulata sensu stricta* has a wider host range as follows: *Cirsium eristhales*, *Carlina acaulis*, *Scabiosa lucida*, *Carduus defloratus* and *Knautia dipsacifolia* (Kreutz, 1995). These reports need to be treated with great caution as errors in identification of *Orobanche* are frequent and the actual host plant is not always evident as it may either be virtually dead or some distance from the parasite.

During the summer of 1995, 414 *O. reticulata* spikes were carefully examined and virtually all were parasitising *C. arvense* plants with the exception of three on *Carduus acanthoides* and one on *Cirsium eriophorum*. In another survey in 1992 only two out of 11 spikes were not parasitising *C. arvense* and they were on *C. palustre* (Foley, 1992). The apparent preference for *C. arvense* may reflect its abundance relative to other species of thistle, but the virtual absence of records from the equally common *C. vulgare* suggests otherwise.

The populations of *O. reticulata* at the sites investigated show marked fluctuations in numbers between years (Fig. 2). Given that the soil type, presence of thistles and vegetation type are relatively constant between years at the sites there are two possible explanations for these large inter-annual fluctuations in numbers of *O. reticulata*, namely disturbance and climatic fluctuations.

A feature common to nearly every site is disturbance. In the river localities flooding can occur (most years and usually during the winter months) which can result in large-scale soil movement, whilst the other sites show evidence of rabbit activity (burrows and scrapes) or mole activity (molehills). The two woodland sites supported strong populations several years after large-scale disturbance by clear-felling or coppicing. It may be true that severe flooding could lead to the extinction of one site only to spread seeds further

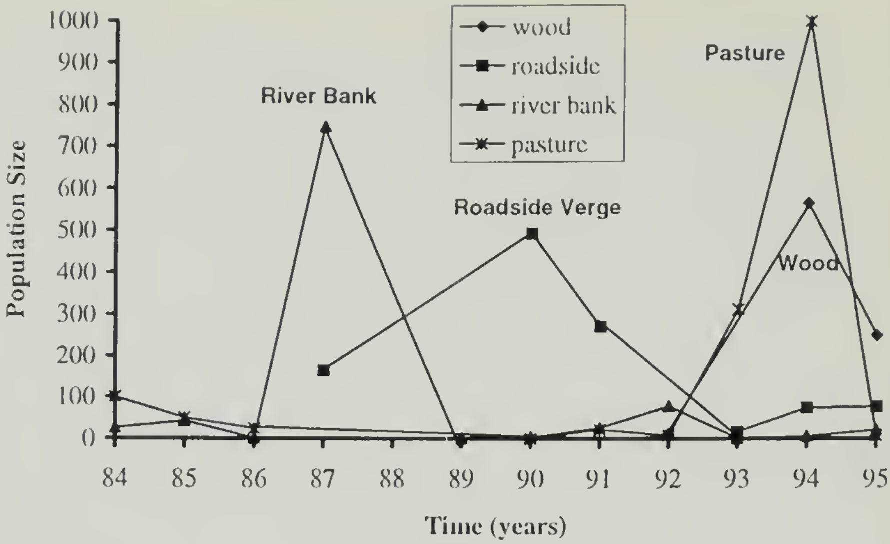

FIGURE 2
The trends in size of *Orobanche reticulata* Wallr. populations at a pasture (cross), roadside verge (square), wood (diamond), and river bank (triangle) in Yorkshire between 1984 and 1995.

downstream, but the populations on the flood-plains tend to remain in the same place, although experiencing large fluctuations in numbers; for example, a population by the River Ure was very large in 1987, with more than 700 spikes. There was heavy rainfall during October 1987 resulting in severe flooding and the population was reduced to a single plant in 1989 (Fig. 2). The same population built its numbers to a peak of 78 in 1992 when a severe flood in September 1992 again reduced the numbers (Fig. 1). Autumn flooding is detrimental to *O. reticulata* by washing away spikes and seeds downstream as well as creating anaerobic conditions in the soil, but spring flooding appears to have little effect, probably due to the fact the tubers are already well established.

On the other hand, disturbance from rabbits is more likely to benefit the spread of *O. reticulata* by creating bare patches for *Cirsium* to colonise and burying *O. reticulata* seeds to the depth required for successful germination and establishment onto its host's root. This stage in the life-cycle of *Orobanche* spp. is probably the most critical for determining the population size as seed production by a single spike can be very large (Salisbury, 1942; Kreutz, 1995). In a study of the serious crop-pest *O. crenata*, Granados and Torres (1993) found that 60% of the seeds produced were viable, but only 0.003% of the viable seeds became attached to a host plant and only 9% of these developed into mature flowering plants. An average *O. reticulata* plant has approximately 50 flowers and with each mature capsule containing between 2,000 and 4,000 seeds, a typical spike will release an estimated 100,000 to 200,000 seeds. The seeds are easily dispersed by wind or water as they are small (0.17 x 0.27mm) and very light (1,000 seeds weigh *c*. 5mg).

Before germination can occur some broomrape seeds require a conditioning period (e.g. several weeks at 20°C for *O. crenata* Forskål) and germination is inhibited by light (Van Hezewijk *et al*., 1993; Bar Nun & Mayer, 1993). Even then seeds will only germinate when stimulated by chemicals released from the host root and the seedlings will die if connection to the host root is not made within a few days. The exact nature of the germination stimulant is still uncertain; however, various workers have suggested ethylene, gibberellic acid and *Rhizobium* nodules as being significant (Jones, 1989; Bar Nun & Mayer, 1993; Parker & Riches, 1993).

Some authors have suggested that fluctuations in population numbers are due to meteorological factors, such as minimum temperatures in winter. In order to test this

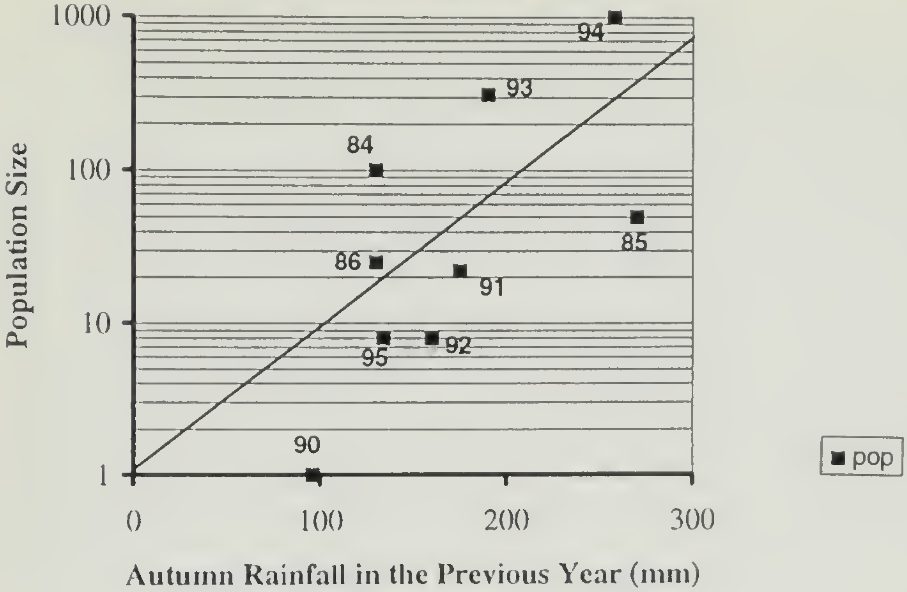

FIGURE 3

Scatter plot of size of the pasture population (logarithmic scale) and total autumn rainfall (sum of September, October and November) at the Durham meterological station in the previous year. Line represents the significant (p = 4.2%) regression between the two variables ($y = 0.0104*\log_{10}$ population – 0.254). Numbers next to the points indicate the year in which the census of the *Orobanche reticulata* Wallr. population was carried out.

pothesis the population numbers at the pasture site were correlated with various climatic riables and a strong correlation was found between population size and the total rainfall the previous autumn (Fig. 3). The populations at the two woodland sites also showed rge increases after the wet autumn of 1993 (Fig. 2). This ties in well with the fact that veral authors have found that seeds of species of *Orobanche* require prolonged moisture d warm temperatures to germinate in experimental conditions, otherwise the seeds enter dormancy phase (Van Hezewijk *et al.*, 1993; Bar Nun & Mayer, 1993). Thus a cold, dry tumn may result in dormancy and few broomrapes the following year. It is unlikely that mmer rainfall or temperatures affect the performance of broomrape since it is rmination which appears to be the critical stage in its development.

The life-cycle of *O. reticulata* has variously been described as annual, biennial and rennial. Observations from the literature and the results from the present population dy (Fig. 3) indicate that it behaves as an annual. Only one herbarium specimen to date ows evidence of spikes being produced in more than one season (Rumsey, *pers. comm.*). conditions are favourable it is likely that seeds dispersed in late summer germinate in the umn and attach themselves to a host root. The underground tuber develops and sends up lowering spike the following summer. If, however, the tuber has not accumulated ough carbohydrate reserves it may persist another year and then flower, and in this case haves as a biennial. Seeds may not, of course, germinate in their first year and there is dence from studies of other broomrape species that the seeds remain viable for at least years if the humidity remains low (Parker & Riches, 1993).

Although seed germination and attachment to its host is probably the most critical part of life-cycle of any broomrape, there are other factors which can limit population size. e tubers of *Orobanche* spp. are a rich source of carbohydrate and are likely to be acked by slugs and insect larvae. The slug *Milax budapestensis* may eat *Orobanche* ers as it is known to consume bulbs and is a common pest of potatoes (Young, *pers. nm.*). Slugs have also been observed to eat the stems of the young spikes as they emerge m the ground and one population had 10 out of 35 *O. reticulata* spikes damaged in this

way. The spikes consequently died before flowering. Slug activity increases during a wet summer which is therefore more likely to be detrimental to populations of *Orobanche*. Sheep have also been observed to eat the young spikes. The spikes are also easily broken through trampling and as they appear to be predominantly monocarpic this activity is also detrimental to seed production.

Pollination is not thought to be limiting as it is carried out by a wide range of species of bee (Jones, 1989) as well as wasps and flour beetles. The developing seeds may however, be attacked by parasitic flies (Linke *et al*., 1990) and various species of fungi (Linke *et al*, 1992).

The density and height of thistle plants in a $1m^2$ circular quadrat that was centred on a *O. reticulata* plant were determined and nearby unparasitised stands were also recorded in the same manner in a total of 26 quadrats at four different locations. Not surprisingly, the height of thistles in the $1m^2$ around the parasite was much lower than for unparasitised stands. The parasitised thistles were even smaller than their neighbours within 50cm of the parasite and they were on average 26.5cm tall and showed varying degrees of chlorosis, retarded flowering, wilting and even death. The thistles that were apparently parasitised would however make only a small contribution to the total number of thistles in parasitised stands and this might therefore indicate that other thistles were also parasitised, but the flowering spikes of *O. reticulata* had not appeared or that the thistles were relatively young.

The density of parasitised stands of *C. arvense* was lower (significant at the 5% level), but there is a great deal of overlap in the density of parasitised and unparasitised stands of thistles (Table 2). The much smaller variation in height and density of unparasitised stands of thistles indicates that these are more likely to be older, well established stands of thistles growing from rhizomes. The parasitised stands show much greater variation in density and height and might therefore include a larger proportion of seedling plants. No relationship was found between the height of the host plant and the height of the parasite. This is not surprising as the size of the *Orobanche* tuber and hence size of the spike will depend on the 'quality' as well as size of the thistle before and shortly after attachment by the parasite and not when it flowers.

The absence of *O. reticulata* from the densest stands of its host plant is paradoxical and requires explanation. This may be related to disturbance, the seedlings of *O. reticulata* becoming established on seedlings of thistle which are likely to be at a lower density than established mature shoots of thistle arising from rhizomes. It is also possible that the chemical signals released by the roots of young and mature plants of thistle are different and it is only the young thistles that become parasitised as a consequence. This enigma still needs further investigation as does the role of slugs as a significant factor affecting the population size of *O. reticulata*.

TABLE 2

The density (m^{-2}) and mean height (cm) of all *Cirsium arvense* plants in $1m^2$ plots with or without the parasite *Orobanche reticulata*.

Cirsium arvense	*Orobanche reticulata*	n	range	mean ± S.E.	t-test
height (cm)	present	117	4 to 145	60±3	16.15
	absent	173	9 to 165	116±2	$p < 0.001$
density (m^{-2})	present	13	4 to 20	9±1.4	2.26
	absent	13	6 to 19	13.2±1.2	$p < 0.05$

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BOOK REVIEWS

Ferns of Hawai'i by **Kathy Valier**. Pp. 88, including 4 figures and 27 colour and 71 black and white photographs. University of Hawai'i Press, Honolulu, Hawai'i. 1995. $14.95

Any botanist who is visiting Hawai'i for the first time will find this book helpful in identifying 62 out of the 200 species of ferns and clubmosses found there. The book has a very strong ethnobotanical slant and includes an introductory section on the basics of the life-cycle of ferns and the terminology used to describe their structure and morphology. The first figure on the evolutionary relationship of ferns to other plants is very simple, but confusing and has been drawn incorrectly. The most annoying aspect of the book to non-Hawaiians is that the legends to the colour plates use mainly Hawaiian names, but they do refer to the page where the plant is described in the text with its Latin name.

ADH

British Plant Communities. Volume 4, Aquatic communities, swamps and tall-herb fens edited by **J. S. Rodwell**. Pp. 283, 16 figures, plus distribution maps. Cambridge University Press, 1995. £60.00 hardback.

Yet another long-awaited volume in the series on the British plant communities based on the National Vegetation Classification. This particular volume includes 24 "supposed" aquatic plant communities and 28 tall-herb and swamp communities described in the usual format (see review in *Naturalist* **118 (1)**: 20 for further details of the format). I use the word "supposed", because in many cases the communities are in fact societies or associations with only a single constant species which is also the dominant and often only species of plant present. For example one sub-community (*Typha latifolia* sub-community) of the *Typha latifoliae* swamp has only 19 other associated species, all of which have a constancy of I (i.e. in less than 20% of all 56 quadrats used to characterise this sub-community). This is a feature commonly found in aquatic and fen communities and raises the question as to whether the idea of a community is a concept that does not apply in nature.

Despite these reservations with some aspects of the approach and theory, this volume will add significantly to our knowledge and understanding of many aspects of ecology. All the books in this series have become firmly established as a framework for a wide variety of teaching, research and management activities in ecology, conservation and land-use planning. This volume will be of particular interest to some Yorkshire botanists in that an example is given of the zonation of swamp communities around ponds in West Yorkshire. This book is definitely for professional ecologists needing it as a reference book and consequently the high price will not deter many such people from buying it as it will be essential to their work.

ADH

AVIAN HABITUATION TO RECREATIONAL DISTURBANCE ON THE NORTH YORKSHIRE COAST

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BSTRACT

ata on recreational pressure (average number of visitors in an hour at low tide) and bird sturbability (distance of the observer at which birds became vigilant or flew away) were ollected from three sites on the North Yorkshire coast. Oystercatchers (*Haematopus tralegus*), Redshanks (*Tringa totanus*) and to a certain extent Turnstones (*Arenaria terpres*) responded differently to human disturbance at the three sites. Bird populations at ley Brigg allowed observers to approach more closely before showing signs of sturbance than those at Cornelian Bay and Ravenscar. The survey sites are similar in omorphological/geographical structure but differ in overall recreational pressure. Birds the site with the highest recreational pressure (Filey Brigg) showed a statistically gnificant difference in disturbability distances. It is suggested that through habituation to sitor pressure birds are able to minimise the effects of disturbance.

TRODUCTION

norebirds are disturbed by human activities (Burger, 1981; Pfister, 1992). However the verity of the disturbance varies, ranging from vigilance and non-feeding to flight, epending on the species of bird and the type of human activity (e.g. Burger. 1981; ayford, 1993; CGO, 1986). Research has shown that people can come within a certain dius around the birds before severe disturbance occurs (e.g. Burger & Gochfeld. 1991; avidson & Rothwell, 1993); for example, Burger and Gochfeld (1991) investigated the lerance of migratory and resident species of birds in Northern India and found that sident birds were more tolerant of people than were migratory species. Studies have dicated that the Oystercatcher, the Redshank (Symonds *et al.* 1984) and the Turnstone Metcalfe & Furness, 1985; Symonds *et al.* 1984), show site fidelity during the winter onths. Bird disturbability is an especially important issue in the winter time when duced feeding opportunities add to the difficulties the shore birds already face in meeting eir energy requirements due to prey scarcity (e.g. Goss-Custard, 1969; Baker, 1981). inter disturbance not only leads to loss of feeding opportunity but also to extra energy pense if the bird is forced to fly (Davidson & Rothwell, 1993). One might therefore pect sedentary species to exhibit behavioural adaptations in order to address such oblems. A suitable strategy might be habituation to the source of disturbance.

The aim of the current study was to investigate the possibility that Oystercatchers, edshanks and Turnstones exhibit levels of habituation to recreational pressure and thus to sess the potential conflict existing between recreationists and the needs of the birds. This as achieved through comparison of bird disturbability at three sites differing in creational pressure.

ETHODS

hree survey sites were chosen on the basis of their similar bird communities and relatively milar geomorphological/geographical structure: Filey Brigg (Site 1, Fig. 1; Grid ref. A130815), Cornelian Bay (Site 2, Fig. 1; Grid ref. TA 060863) and Ravenscar (Site 3, g. 1; Grid ref. NZ979026). All three sites can be classed as rock-dominated coastlines d all three possess boulder-strewn wave cut rock platforms. The coastal morphology of e sites is dominated by the dip and strike of the underlying geology and the preferential osion of the sedimentary rock beds.

The three sites were deemed to differ substantially in recreational pressure. All sites

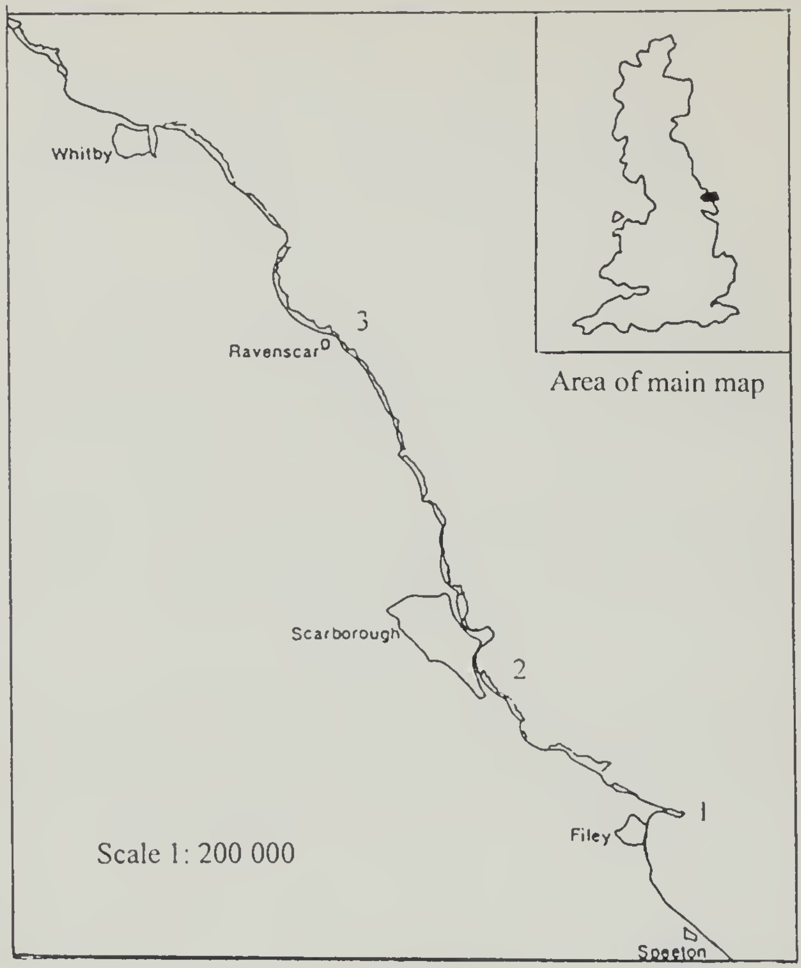

FIGURE 1
Map showing the location of the Filey Brigg, Cornelian Bay and Ravenscar survey sites. Site 1 = Filey Brigg, Site 2 = Cornelian Bay, Site 3 = Ravenscar.

were visited five times in the period between 18 February and 5 April 1995, four times on a weekday and once on a Saturday. Each visit occurred approximately one hour before low tide when the shore birds were expected to be feeding (Burger, 1991) and when people were also expected to be present. Each survey lasted for an hour during which observational data on bird disturbability was collected as well as data on recreational pressure. Weather conditions were constant over the 15 study days. All statistical analyses were performed on/with the MINITAB for Windows statistical software package (MINITAB 1994).

Recreational pressure
Recreational pressure on the three field sites was investigated by counting the number of visitors to the sites during the one hour survey period, before or at low tide, when the number of people tends to be highest. Visitor pressure also tends to be higher at weekends and the survey days were chosen to fall on four weekdays and one Saturday in order to get an overall impression of this impact on the sites. The recreational activity is expressed by the average number of visitors over the five study days (Table 1) (Niggebrugge, 1991). At Ravenscar and Cornelian Bay these counts were made by the observer(s) at the same time as the bird disturbability data was gathered. This was not possible at Filey Brigg where the number of visitors is higher; here one observer counted the visitors while another collected disturbability data.

The main activities of the visitors to the three sites were (dog) walking, bird watching, ngling, winkle and fossil collecting, which can all cause birds to be disturbed.

ird disturbability

he data on bird disturbability were gathered by one or two observers approaching the ird(s) at a constant (slow) speed and noting the distance from the observers at which the irds became vigilant and/or flew off. Where a flock of birds was observed the distance at hich the first bird became disturbed was taken as the event. In cases of mixed-species ocks the species were recorded and the first bird of each species was used to obtain the ata. Notes were taken on the number of birds of each species present.

At each site the same route was taken on the five visits, covering both open flats as well s boulder-strewn shores. Following a roughly circular route allowed data to be collected n most of the birds present and also allowed the birds to "escape" once observed, thus nsuring that the same set of birds were not disturbed repeatedly.

At fourteen of the fifteen surveys AN was the main and/or sole observer, ensuring that ata were comparable between and within sites. Although an attempt was made to measure he distances between the birds and observer(s) this proved impracticable, and it was herefore decided to estimate them. These estimates were corroborated between the bservers and found to be consistent with actual measured trials.

ESULTS

ecreational pressure

he data on visitor numbers indicate that there is an overall difference in recreational ressure between the three sites. Table 1 shows that Filey Brigg has the highest average umber of visitors per hour (Mean±S.E. = 44±12.2) followed by Cornelian Bay (10±2.85). avenscar has a relatively low average number of visitors (7±3.18). A one-way analysis of ariance (ANOVA $F_{2,12}$ = 7.33; p = 0.008) (with Tukey's pairwise comparison) emonstrates a statistically significant difference between Filey Brigg and Cornelian Bay d between Filey Brigg and Ravenscar, but not between Cornelian Bay and Ravenscar (p 0.05).

TABLE 1

Number of people pursuing recreational activites at the three sites on different days of the week (daily totals and sample means±S.E.).

	Site No.	Mon.	Tues.	Wed.	Thurs.	Sat.	Total Visitors	Mean ±S.E.
ley Brigg	1	32	23	17	74	72	218	43.6±12.2
ornelian Bay	2	0	16	9	11	15	51	10.2±2.85
avenscar	3	3	8	2	3	19	35	7.0±3.18

(In the header, "Number of Visitors per Survey" spans the Mon.–Sat. columns.)

rd disturbability

ata concerning the disturbability of Oystercatchers, Redshanks and Turnstones were llected at the three sites. Kruskal-Wallis tests (Watt, 1992) were carried out to compare e mean disturbance distances for these species at the three sites (Table 2). From the table is clear that, in the case of both Oystercatchers and Redshanks, statistically significant fferences in levels of disturbability exist at the three sites. In the case of both these ecies, birds can be approached most closely in the site rank order Filey Brigg>Cornelian y>Ravenscar. The picture is less clear in the case of Turnstones, probably because of the all number of observations available from Ravenscar. However, the available data do ggest that Turnstones can be approached more closely at Filey Brigg than at Cornelian y. (The indicated distances represent the distance between the observer and the bird. nsequently the distances at which the birds flew away are smaller than those at which the d became vigilant.)

TABLE 2

The distances at which Oystercatchers, Redshanks and Turnstones were disturbed at the three sites.

Type of disturbability	Species	Site no.	N	Mean±SE	Kruskal – Wallis test H	p
Vigilant	Oystercatcher	1	52	22.38±1.26	53.71	0.001
		2	40	37.13±2.70		
		3	34	41.76±2.10		
	Redshank	1	20	18.75±1.63	20.20	0.001
		2	17	35.29±4.51		
		3	4	38.75±4.27		
	Turnstone	1	13	8.77±1.26	23.05	0.001
		2	41	27.73±3.01		
		3	1	15.00		
Fly away	Oystercatcher	1	50	14.120±0.892	60.34	0.001
		2	39	25.64±1.59		
		3	34	33.09±1.96		
	Redshank	1	20	11.600±0.887	27.84	0.001
		2	17	24.71±2.16		
		3	4	35.00±4.56		
	Turnstone	1	14	4.21±1.25	20.79	0.001
		2	40	10.10±1.02		
		3	1	8.00		

Discussion

From the data presented in this study it is clear that different rocky shore sites are subjected to differing levels of recreational disturbance. As has been suggested, a strategy which allows minimisation of the disturbance caused by recreation might be crucial to the winter survival of the rocky shore waders considered (Oystercatchers, Redshanks and Turnstones) (e.g. Goss-Custard, 1969; Baker, 1981; Davidson & Rothwell, 1993), especially since these species are largely sedentary (Metcalfe & Furness, 1985; Symonds *et al.* 1984). It is also clear that these three species of rocky shore waders differ in their levels of disturbability at the three sites. However, their rank order of disturbability appears to vary consistently between sites, such that, for example, birds of all species were less susceptible to disturbance at Filey Brigg than at Cornelian Bay. As has been stated, the physical structure (and presumably biological structure) of the three sites are similar. The main difference between sites appears to be recreational pressure. We therefore infer a link between levels of visitor pressure and levels of disturbability and suggest that habituation to recreational disturbance has occurred.

The findings of this study and those of previous authors (e.g. Burger and Gochfeld, 1991; Cayford, 1993; Davidson and Rothwell, 1993) strongly suggest that habituation might be an effective means by which birds optimise feeding opportunities in a disturbed environment, demonstrating that human recreation and the needs of bird communities might not be in conflict. It should, however, be borne in mind that non-sedentary species may not have the opportunity to become habituated.

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BOOK REVIEWS

...uritus. A Natural History of the Brown Long-eared Bat by Robert W. Howard. Pp. ...0. 1 b/w photograph, 1 map, 7 figures and 13 tables. William Sessions, York. 1995. ...3.50.

...he author, already acclaimed for his book *Badgers without Bias*, is a retired veterinary ...rgeon and a keen lifelong naturalist with a special interest in Britain's mammal fauna. ...is 15-year study of a colony of brown long-eared bats (*Plecotus auritus*), which ...rtuitously reside in the attic of his home in Chewton Keynsham near Bristol, has led to ...e compilation of the first comprehensive monograph of any species of British bat. The ...ork is not only an account of the author's "in-house" *Plecotus* colony, though this would ... worthwhile in its own right. Each chapter is developed into a comprehensive review and ...scussion of current research, knowledge and opinion. The sixteen chapters cover a range ... topics, including nightly and seasonal activity patterns; reproduction; prey; flight; sound, ...trasound and communication; and why long-eared bats have such big ears. The seven

appendices, which deal with anatomical vital statistics, dentition, echo-location, and aspects of legal protection, form a useful quick reference. The very comprehensive bibliography, including historical and current literature, is particularly valuable.

This inexpensive yet information-packed treatise is compulsory reading for all bat enthusiasts and students of mammalogy.

CAH

Harm De Blij's Geography Book by **Harm de Blij**. Pp. 336, with 16 b/w maps and 6 diagrams. Wiley. 1995. £17.95.

In 1989 an American TV station put a "world awareness slot" into one of their leading news programmes. They employed an academic geographer, Harm de Blij, to ensure that the content would help stem the growth of geographical illiteracy in the American population. Guided by the response to this programme, the themes which generated most interest have been expanded to create this book.

The volume is a highly idiosyncratic pot-pourri of themes, ranging from global warming, through frontier conflicts to AIDS! Whilst the style is distinctly popular, the content is clear, well informed, commendably up to date and often thought-provoking. The weakest sections are those covering continental drift, earthquakes and weather but fortunately these make up only a minor portion of the collection. The sections on global demography, the growth of economic activity on the "Pacific rim", on the decline of nation-state power and of the problems arising from the disintegration of the USSR are particularly interesting. Moreover, the book's overall perspective, in which European interests are allocated only just over twenty pages, may usefully disturb many British readers' existing world view. Though the sections rarely explore themes in depth, the large number of thought-provoking "potted accounts" of problems which are present in many parts of the world will provide the reader with a clear picture of how the world is changing and as such the book is to be recommended.

DEC

Tales of the Earth: Paroxysms and Perturbations of the Blue Planet by **C. Officer** and **J. Page.** Pp. xiii + 26 with 46 graphs/line drawings and 26 b/w pictures. Oxford University Press, 1993. £15.95.

This work provides an interesting overview and perspective of the natural and man-induced changes which have influenced the earth and its life forms, particularly over the last 20,000 years.

The first four chapters examine the effects of earthquakes, volcanic eruptions, meteorite impacts and floods upon human societies in both recent and historic times. A further two chapters examine the impact of climatic change upon organisms in the period before the Industrial Revolution and sets out the hypotheses which have been advanced to account for the demise of the dinosaurs at the Cretaceous/Tertiary boundary and of the mammoths and mastodons in the post-glacial period.

The last three chapters of the book examine human impacts upon the world's physical and biotic environments and question whether our society is allocating research funds in ways which are appropriate to provide help in coping with the massive problems facing humankind in the coming century. This question is put into the context of the contemporary problems of smogs, global warming, acid rain, environmental disturbance and the extinction of species.

Though few concepts are dealt with in detail, the work provides adequate references to readily accessible sources. A strong merit of the work is that it makes a large number of important, recent concepts from the earth and biological sciences available to the general public in an easily understood format with little scientific or technical jargon.

DEC

BOTANY OF "THE HAW" NEAR SKIPTON: PAST, PRESENT AND FUTURE

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INTRODUCTION

"The Haw", a much-quarried hill east of Skipton, North Yorkshire is represented on recent OS maps mainly by a large blank area reflecting a flux in topograpy which has accelerated in recent years (Hambler, 1995). This flux has mainly involved quarrying, landfill and embankment; all have affected the vegetation and flora but it will be shown that other anthropogenic changes have also been important.

The Haw lies largely within the 2km NG Tetrad NE0052, extending 0.5km to the east (Fig. 1) The names by which land parcels on The Haw were known in the 18th century are used here in quotation marks, together with numbers relating to a Plan of the Manor of Skipton produced by Thomas Crow in 1757. Part of the Plan was copied and presented in an earlier paper (Hambler, 1995); outlines of fields and their numbers only are shown here (Fig. 2). "Hawbank Rock" and "Lookabout" (Fig. 1) are names which may have originated later than Crow's time, in relation to quarry precincts at the western end of the hill.

The soil of The Haw, where undisturbed, is mostly circum-neutral calcareous brown-earth, overlying Carboniferous Limestone and shales; a longitudinal east/west core to the elongated hill comprises strata which are commercially valueless. Quarrying has taken place on either side of the core, itself grossly breached in 1960 to leave a cleft which is still being expanded (Hambler, 1995).

Acidic becks, draining moorlands to the north and to the south, skirt The Haw which has itself no evident drainage channels; some pasture soil at its eastern end has been found to be mildly acidic.

All of the vegetation of The Haw has long been entirely anthropogenic – resulting from animal husbandry (including deer keeping); quarrying and reclamation; and railway construction. Nevertheless wild, sometimes alien, higher plant species continue to find niches. Reasons for the absence, gain or loss of certain species are adduced here, and a few opinions are ventured on the potential of the topographical relict for species conservation. Broad vegetation types and their origins are described first; then interesting individual species are considered.

Interest may be perceived in terms of rarity, disjunct distribution, absence from habitats presumed suitable, or simply attractiveness. It was a criterion used in compilation of a list of plants found "about Skipton" by Baker 1907, and implicitly by Rotheray (1900) who quoted parts of The Haw as the provenances of certain species. Unfortunately Lister Rotheray's "huge herbarium . . . and records" were burned (Frankland, 1987), so any relevant information has been lost. Interest is important in the promotion of modern conservation, and it is suggested that whilst quarrying has been responsible for creating habitats for a number of interesting species on The Haw, loss of species has often been through other causes – drainage, pasture improvement and reclamation.

WOODLAND

Hazel (*Corylus avellana*) was likely to have been spared during forest clearances which began in the Neolithic and continued "into Roman times" (R. Housley *pers. comm.*). There is thus a likelihood that this species has existed continuously on The Haw for thousands of years. Mention of nuts, and of woodland at "Scribeden" and "at Hawe" (Hambler, 1995) in old documents suggest the location of this useful native. Concomitant mention of pine wood suggests an alien introduction (see Carlisle & Brown, 1968) in medieval times.

A large patch of mixed woodland was conspicuous on the crest of the hill in the middle of the 18th century; this was in "The Haw Park L296". A smaller mixed patch was present

to the east in a field with several uses – "The North Hills Q321". These patches were shown on small scale county maps dating from early in the 19th century (e.g. Henry Teesdale published 1828). The first "six-inch" OS map (Fig. 1) surveyed in 1850 showed that the smaller patch had been destroyed, and the tree symbols suggest that any Scots Pine (*Pinus sylvestris*) trees on the hill had gone. In "The Haw Park L296" only scattered Ash (*Fraxinus excelsior*) trees, colonising Hawthorns (*Crataegus monogyna*) and a few marginal Hazels may have escaped wholesale local exploitation of trees to feed lime kilns between 1750 and 1850.

Hazel coppice with overtopping Ash trees and prevernal herbs such as *Primula vulgaris* (Primrose) may once have been extensive on The Haw, with Hazel a conserved relict of the prehistoric Ash-Hazel wildwood. Ash and Primrose co-exist today (occasionally with Hazel) in various small areas; one was once part of "The Haw Park L296" – on the north-facing consolidated scree slope of "Lookabout" (Fig. 3); another was once the southern edge of "The North Hills Q321" – becoming, later, the roadside boundary of a quarry (Skibeden Quarry on recent OS maps). Hazel, "the forerunner and associate of Ash on the limestone" (Smith & Rankin, 1903), is now ". . . the most seriously threatened British tree except elms . . ." (Rackham, 1986); its decline on The Haw, with no sign of regeneration, is not an isolated occurrence!

The only mature woodland on The Haw now is on 19th century spoil from the (then) Haw Bank Quarry (Fig. 5), which alongside the present access road to Skipton Rock Quarry is comprised mainly of Scots Pines and spindly, closely spaced Larch (*Larix decidua*). Beech (*Fagus sylvatica*) appears to have been introduced later; it dominates much of the woodland visible above Haw Laithe on Figure 5. These species represent continuity in a "tradition" of introducing alien trees to The Haw. The trees, planted in the second half of the 19th century, screened Haw Bank Quarry, with its works buildings, from Embsay village. The conifers were sufficiently mature to be symbolised on the "twenty-five-inch" OS map of 1891, and to be colour-coded as "Scots Pine and Larch" by Smith and Rankin (1903) on their 1:126,720 scale vegetation map. A photograph in the R.G. Rowley Archive (Skipton Public Library) illustrates the earliest phase of this reclamation. The "twenty-five-inch" OS map of 1909 shows that the area of tree-planting had been extended by 1907 eastwards to its present limits around the right-of-way from Embsay over The Haw, and symbols suggest a mixed coniferous/deciduous plantation.

The tree canopies allow little undergrowth apart from *Dryopteris filix-mas* (Male Fern), but along woodland margins, and along pathways, such as the right-of-way uphill from Embsay, and a path north of the access road to Skipton Rock Quarry, there are shade-tolerant shrubs, including *Rubus fruticosus* agg (Bramble), *Rosa canina* (Dog Rose), *Sambucus niger* (Elderberry), and common shade-tolerant herbs, including *Arum maculatum* (Cuckoo-pint, Lords-and-Ladies), *Carex sylvatica* (Wood Sedge), *Sanicula europaea* (Sanicle), *Urtica dioica* (*Stinging Nettle*), and *Phyllitis scolopendrium* (Hart's-tongue Fern). Also present is *Rosa mollis* (Soft Downy-rose), an early-flowering native that is not abundant in Yorkshire; it received mention by Baker (1907) as a species of interest "about Skipton".

Woodland to Scrubby Pasture

Large trees present in "The Haw Park" relict were indicated on the "six-inch" OS map of 1854. The symbols presumably represent Ash (*Fraxinus excelsior*) individuals, but they are so few as to suggest that no woodland had survived the previous one hundred years. On the "twenty-five-inch" map of 1889 tree symbols are more numerous. This suggests that Ash trees which colonised the hill contemporaneously with destruction of the old deer park woodland to feed lime kilns between 1750 and 1850 had matured.

Swarms of minute dots on the 1854 OS map (Fig. 1) suggest that the cartographers had attempted to represent Hawthorns (i.e. developing scrub). No tree symbols or dots are present around "Lookabout", suggesting that the present light woodland, on the consolidated scree (Fig. 3), comprising large Ash trees, with abundant Hawthorns and a

few Holly trees (*Ilex aquifolium*), is of recent natural origin. Crow's notebook description of "The Haw Park" as woody pasture in 1757 suggests that his cartographic symbolism might, even then, have been idealised. "Haw Park" on the 1854 "six-inch" map does not cover the westernmost part of the park as recognised by Crow, and extends far beyond his easternmost wall shown (just east of the relevant "P" on Fig. 1).

The trunk girths of Hawthorns on the southern slope of "The Haw Park L296" in 1993 varied between 0.47m and 1.24m. The form of these trees – with distinct trunks (cf. Fig. 3) – suggests a period, probably early in the 19th century, of natural colonisation with little grazing, followed by a long period with no regeneration. The Hawe Park [sic] had been described as a bushy pasture by Whitaker (1878). Symbols suggesting shrubs on the "twenty-five-inch" OS map surveyed 1889 surmount "tussocks" intermingled with short stippled lines; the symbolism is likely to have represented "feg" – described below. Stumps, now present, show where some of the old Hawthorns have been felled.

Relicts of the old woodland margins along the A5 roadside (the southern border of "The Haw Park") include Sloe (*Prunus spinosa*); Holly, Ivy (*Hedera helix*) mounting the ancient dry-stone walls, and *Brachypodium sylvaticum* (False Brome) which is "often relict from woodland" (Clapham *et al.*, 1987). The roadside row of tree-symbols along the southern flank of The Haw on Figure 1 probably represent mainly Sycamore (*Acer pseudoplatanus*) – and illustrate a further example of the introduction of an alien tree to The Haw.

Pastures and "Improvement"

For at least 200 years the most extensive vegetation on The Haw has been pasture, some underused and woody, some parts flushed by ephemeral springs, and some boggy (Hambler 1995). Of the land parcels on and around The Haw described in Thomas Crow's Field Book only "The North Hills Q321" (Fig. 2) was recorded by Crow as partly arable (and partly woody). Today there are common species of alkaline to neutral (*sensu* Tansley 1949) grasslands in every fragment of the 18th century enclosures north of the A59 road; those relicts which remain as pastures have been improved by manuring over many years. Pastures south of the A59 road have been largely modified by more intensive farming techniques, including cultivation of productive grasses, and are botanically uninteresting except in the immediate vicinity of Skibeden Beck.

The old, unplanted but still grazed swards north of the A59 road include *Agrostis capillaris* (Common Bent), and *Cynosurus cristatus* (Crested Dog's-tail), a valuable grass in second class pastures (Tansley, 1949). Also present, but suppressed by grazing, are two competitive grasses: *Arrhenatherum elatius* (False Oat-grass), and *Deschampsia cespitosa* (Tufted Hair-grass).

Rough grassland dominated by these two species results when pastures on the brown earth soil are underused: the name "Fegg Field" for enclosure "P314" (Fig. 2) suggests such grassland ("fegg" is an English dialect term). It is represented today by an ungrazed fragment of calcareous pasture (soil pH 8.2) which escaped the dumping of spoil in the 1970s – the north western corner of "the North Hills Q321". Here, the presence in 1990 of the fern *Ophioglossum vulgatum* (Adder's-tongue) indicates the ancient origins of this grassland relict.

That all of the remains of the circum-neutral to acid pasture sward at the eastern end of The Haw is ancient (*sensu* Rackham, 1986) was shown by the presence of Adder's-tongue in 1990. The fern's habitat evidently included, in the past, the entire northern slope of The Haw eastwards from the boundary of "The Haw Park" to the vicinity of Holy Well where the soil has a mildly acid reaction – pH 6.4 – (land parcels Q321, R326 and R327 of Fig. 2).

Quarrying is currently encroaching into "R327", and will reach its eventual eastern limit at a north/south tree screen, planted round 1980, across the middle of the field. Although this eastern part of the hill was included in an area of "Cultivation, with wheat", mapped by Smith & Rankin (1903) it seems unlikely that wheat has been cultivated on The Haw during the present century.

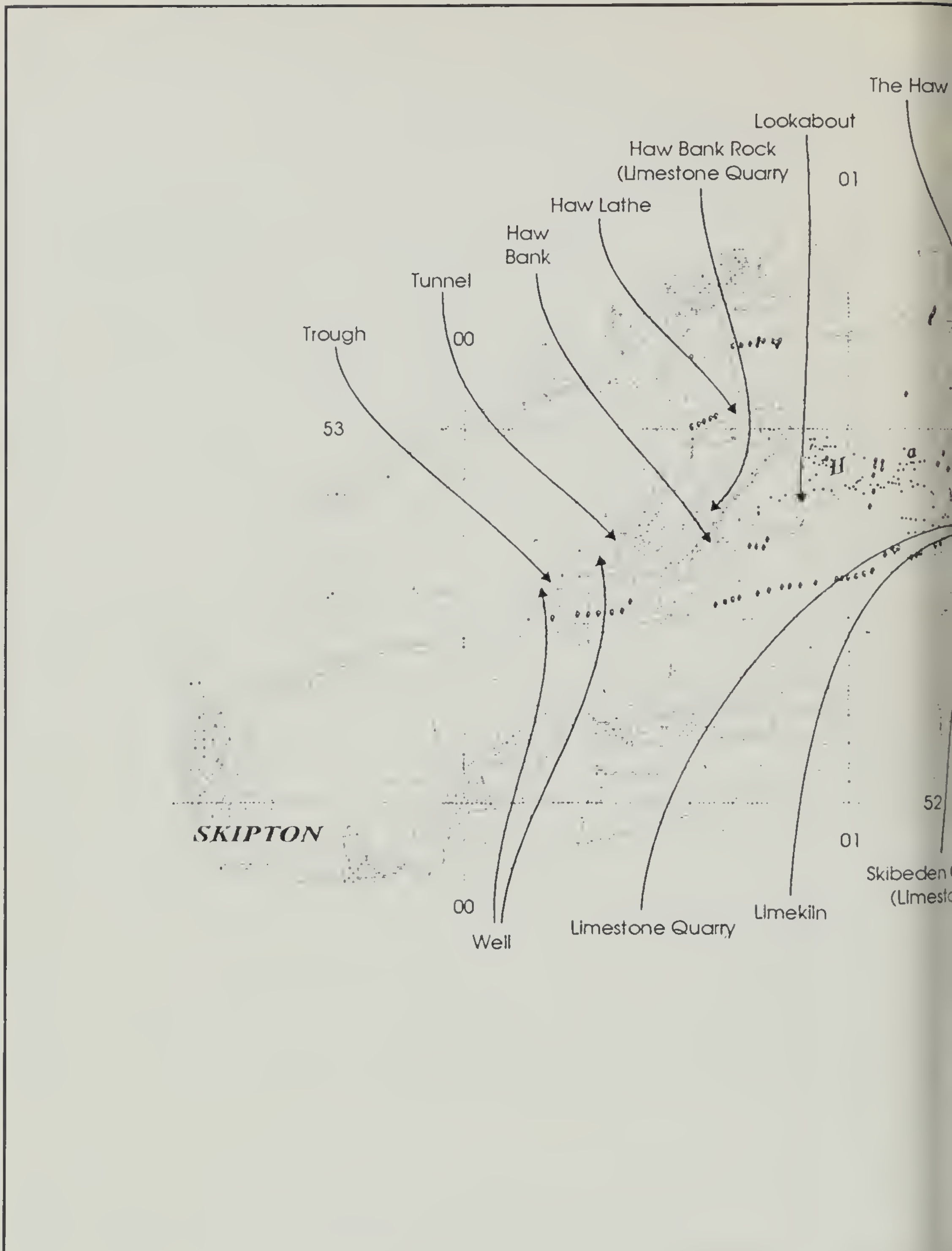
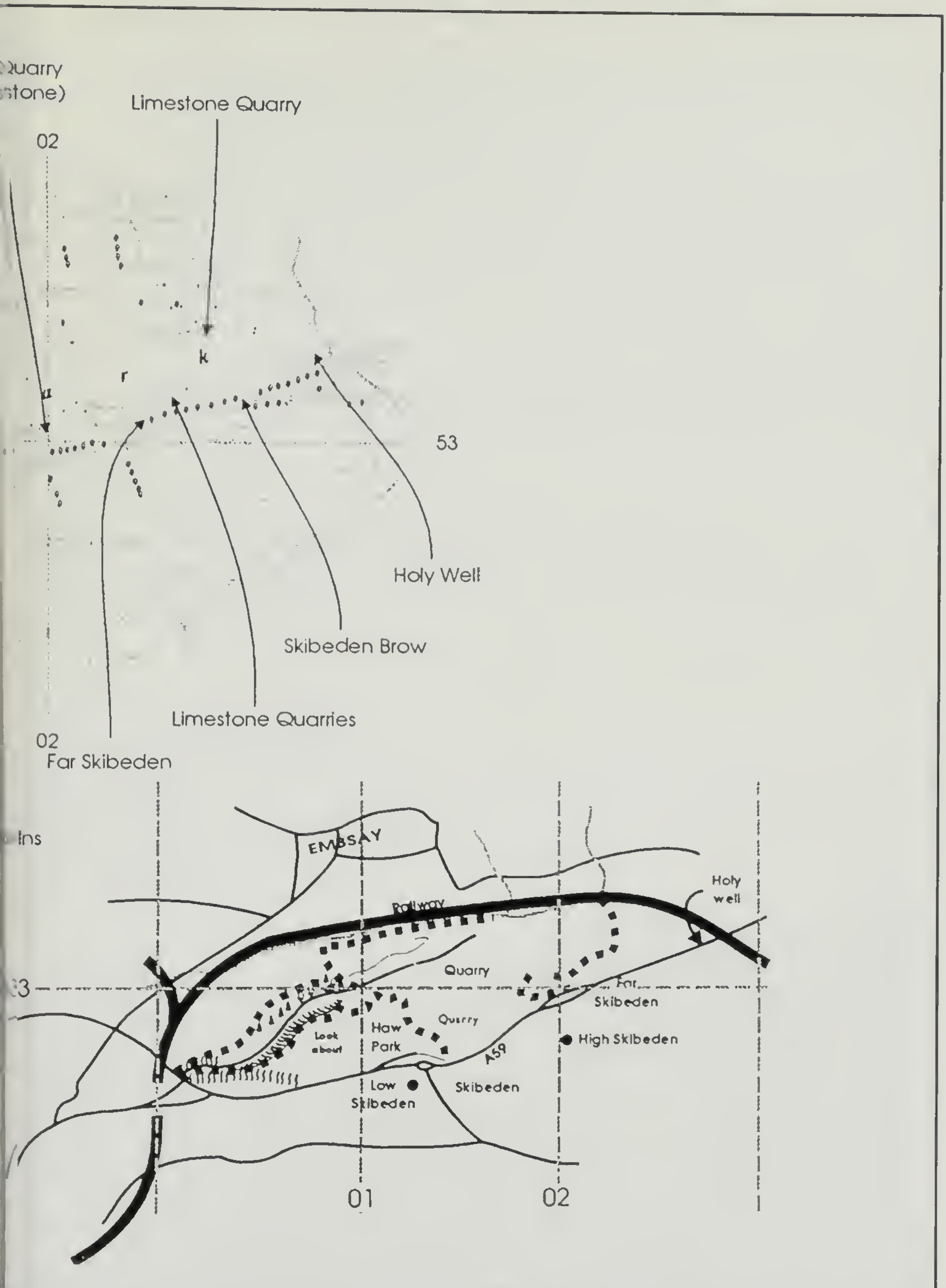


FIGURE 1
Illustration derived from the first six-inch OS map (Sheet CLXXXV) showing The Haw – surveyed in 1850. Dots representing shrubs are enlarged and tree symbols enhanced. Inset shows modern roads; the railway completed in 1888; an outline of the quarried areas with Skipton rock quarry to the north of line 53, and the Skibeden complex of merged quarries to the south. 1km squares superimposed.


Quarry
stone)
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Railway
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High Skibeden
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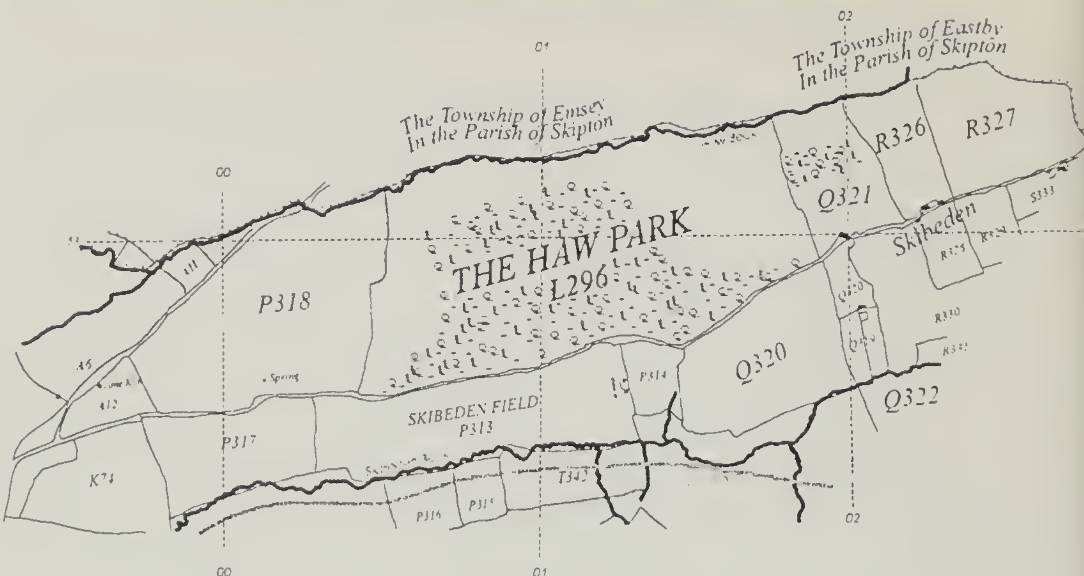

FIGURE 2
Numbered fields on The Haw in 1757 (after Thomas Crow's Plan of the Manor of Skipton . . .). Names of becks, as given by OS, added.

FIGURE 3
The ridge and crag labelled 'Lookabout' (or 'Look-about') on OS maps, seen from the north-east. Leafless large trees are Ash; smaller trees are Hawthorn. An east/west row of Beech trees lines the southern lip of 19th century quarry workings on the extreme right (April 1995).

"The Haw Park" relict was mapped as "Natural Pasture: Grasses, no heath plants" by Smith and Rankin (1903). What remains is grazed to a sward by sheep and cattle; it is relatively species-rich on the stony ridge around Lookabout crag (Fig. 3). Here stress-tolerators such as *Festuca rubra* (Red Fescue), *Briza media* (Quaking Grass) and *Trisetum flavescens* (Yellow Oat Grass) are advantaged.

At the southern foot of the crag a narrow fringe of the grassland has escaped improvement and is rich in drought-tolerant calcicolous species including *Thymus polytrichus* (Wild Thyme), *Helianthemum nummularium* (Common Rock-Rose) and *Geranium molle* (Dove's-foot Crane's-bill), whilst among rocks on the northern side (Fig. 3) shade-tolerant species such as *Geranium robertianum* (Herb Robert) and *Dactylis glomerata* (Cock's-foot) are more abundant. The northern slope (Fig. 3) below, and east of, the crag is a consolidated scree. The grassland here, and in very small ancient hillside quarries south of Lookabout, is dominated by Ash trees and Hawthorns; beneath the former, Primroses and Cuckoo-pints are abundant. A flushed area nearby is fed by a spring in the north-west corner of grid square SE0152 (Hambler, 1995). Here *Agrostis stolonifera* (Creeping Bent), *Bellis perennis* (Daisy) and *Prunella vulgaris* (Self-heal) are more conspicuous.

One small hydrophile species, *Primula farinosa* (Bird's-eye Primrose) which was found on Hawbank during the 19th century (Table 1) might have existed as an arctic-alpine relict in this vicinity before improvement and intensification of grazing.

Sown reclamation-grassland has originated on The Haw only during the past few decades: south facing spoil slopes and embankments along the A59 road and at Far Skibeden have been sown with grasses (and later, in part, densely planted with young trees). An area on the northern slope east of grid line E017, comprising spoil and scraped soil, is gradually being rehabilitated as nutrient-stressed calcareous grassland, with trees and shrubs, which may become species-rich (Dixon & Hambler, 1993).

Aquatic Habitats and Wetland

Haw Beck and Skibeden Beck are swift, narrow streams which, with their tributaries, drain (respectively) acidic gritstone hills to the north and to the south of The Haw. The water of Haw Beck had a pH of 8.0 in November 1993, suggesting a moderation of acidity by surface drainage and silt from the quarried area.

Riparian communities are present everywhere a beck flows through grazing-land. These communities are characterised by "land-based" *Agrostis stolonifera* (Creeping Bent) spreading into the water, and by *Glyceria fluitans* (Floating Sweetgrass) which is attractive to cattle. Even where Skibeden Beck flows in its own narrow channel, e.g. in parts of "Skibeden Field P313", this grass and other plants emergent from the channel are grazed. There is now little pasture on The Haw alongside Haw Beck. Only for a few hundred metres west of NG line E01 does the beck flow untrammelled through grazed fields.

The becks provide habitats for emergent-aquatic plants. *Iris pseudacorus* (Yellow Iris) and *Sparganium emersum* (Unbranched Bur-reed) root in the channels. *Rorippa nasturtium-aquatica* (Water-cress) spreads between open water and any small mires trodden by cattle. *Veronica beccabunga* (Brooklime) similarly occurs in mires and around the water-level in unculverted stretches of the becks. Although *Hydrocotyle vulgaris* (Pennywort) was found in 1984, low down on the side of the Haw Beck channel near the confluence with Kempley Beck, its sometime associate of acid substrates *Isolepis setacea* (Table 1) was not found.

There is a small abandoned quarry pond near the Kempley Beck/Haw Beck confluence in the north-east corner of "The North Hills Q321", which carries emergent vegetation, rooted in a substratum of pH 7.4. Here *Juncus inflexus* (Hard Rush) and *J. effusus* (Soft Rush) are co-dominant, over a moss carpet largely comprising *Calliergon cuspidatum*, *Cratoneuron filicinum* and *Brachythecium rutabulum*. The species composition is similar to that of small trackside marshy pools (pH 8.2) high on the hill (Hambler, 1995). This community, and respective stands of *Carex acutiformis* (Lesser Pond-sedge) and

TABLE 1
Vascular Plants and their provenances recorded by Rotheray (1900) – scientific names adjusted in accordance with Stace (1991)

Aira caryophyllea u	Silver Hair-grass	Skipton Rock
Anchusa officinalis *	Alkanet	Hawbank Rock
Anthemis arvensis u	Corn Chamomile	Waste ground nr. Hawbank
Anthyllis vulneraria *o	Kidney Vetch	Hawbank Rock 1889, now gone
Aphanes arvensis *	Parsley-piert	Hawbank
Campanula latifolia *	Giant Bellflower	Skideben lime-quarry in hedge
Cardamine hirsuta *	Hairy Bitter-cress	Tramway side to Hawbank
Cynoglossum officinale o	Hound's-tongue	Hawbank
Dactylorhiza incarnata uo	Early Marsh Orchid	Rubbish heaps, Hawbank Rock
Fragaria moschata u	Hautbois Strawberry	Tramway side to Hawbank Rock
Gentianella amarella r	Autumn Gentian	Hawbank Rock & adjoining pasture
G. campestris uo	Field Gentian	Hillside, Hawbank Quarry
Helictotrichon pratense r	Meadow Oat-grass	Hawbank
Hesperis matronalis *	Dame's Violet	Hawbank (r nearby)
Isolepis setacea uo	Bristle Club-rush	Hawbank Rock
Koeleria macrantha r	Crested Hair-grass	Hawbank
Lepedium ruderale u	Narrow-leaved Pepperwort	Waste ground nr. Hawbank Rock
Lysimachia nemorum *u	Yellow Pimpernel	Hawbank Rock
Mentha pulegium o	Pennyroyal	Rubbish heap Hawbank Quarry, Adventive
Orchis mascula uo	Early Purple Orchid	Rubbish heaps Hawbank Rock
Origanum vulgare *r	Marjoram	Skibeden Limekilns
Parnassia palustris uo	Grass-of-Parnassus	Hawbank Rock, 1888, now gone
Pimpinella saxifraga r	Burnet Saxifrage	Hawbank Rock
Primula farinosa uo	Bird's-eye Primrose	Hawbank
Rubus affinis §	Bramble	Skipton Rock
R. caesius *r	Dewberry	Skibeden Limekilns
R. vestitus §	Bramble	Hawbank Rock
Scabiosa columbaria *r	Small Scabious	Hawbank Rock
Sherardia arvensis *r	Field Madder	Hawbank
Silaum silaus r	Pepper Saxifrage	Hawbank Rock
Silene vulgaris o	Bladder Campion	Skibeden Limekilns
Stachys officinalis r	Betony	Hawbank, dry banks and in pastures
Tragopogon pratensis *r	Goat's-Beard	Tramway side to Hawbank
Trifolium campestre u	Hop Trefoil	Tramway side to Hawbank
Valeriana dioica *o	Marsh Valerian	Boggy field Hawbank
Vicia sativa ssp. *nigra* r	Common Vetch	Rubbish heaps Hawbank

Key (symbols refer to anywhere on The Haw): * – refound in 1940s by J. N. Frankland; r – recorded recently by M. Ingham, Mrs C. A. Johnson and/or the author; o – recently and specifically sought but not found; u – apparently unrecorded during present century, § – taxonomic uncertainty. Note: 'Skipton Rock' probably refers to post-1856 quarry workings east of the earlier Haw Bank Quarry.

Equisetum palustre (Marsh Horsetail), are mutually exclusive over parts of the pond which dried out completely in the exceptional summer of 1995).

Nearby, between a loop of the beck and the railway, along 200m of the beck west of line 02 on Figure 1 inset (strictly, separated from The Haw as defined here) is an ungrazed drier marsh with abundant *Carex acutiformis* (Lesser Pond-sedge), *Filipendula ulmaria* (Meadowsweet), *Phalaris arundinacea* (Canary Grass), *Valeriana officinalis* (Common Valerian) and other common plants of tall-herb-fen. The last three species also occur less abundantly with grasses and sedges, including *Carex hirta* (Hairy Sedge), in the ancient grassland footing the spoil on the opposite (Haw) side of the beck – a clear demonstration of the ancient gradation between the vegetation of the hillside, damp through its surface drainage, and that of the flood-plain of the beck.

Cirsium palustre (Marsh Thistle) occurs frequently in both communities, and colonised immediately and abundantly the lowest part of the northern hillside after the humic soil horizon and vegetation had been completely scraped off during a landscaping operation in 1984. This scraped area of brown earth soil is becoming revegetated by hypnoid mosses and sown grasses.

An illustration (Hambler, 1995) postulates a wetland/damp pasture border along the entire course of Haw Beck. Records of individual plant species discussed below suggest that part of this wetland at the northern foot of "The Haw Field and Hawbank P318" (east of NG intersection SE0053) was species-rich and easily accessible before the railway was constructed. A patch of "laminated clay" is shown on an annotated map in The Arthur Raistrick Archive (Skipton Public Library), along the northern foot of The Haw (and within The Haw Park L296); it was associated with a tiny tributary beck (Fig. 1) and was possibly the provenance of 19th century records of some wetland species no longer found.

Rocky Places with Shallow Humic Soils

The near-vertical bedding of the Skipton anticline has largely precluded formation of ledges on quarry faces: thus the exposed rock (Fig. 4, Fig. 5a) remains bare. Only two vascular plant species confined to rock-face habitats could be found recently on The Haw: one is a fern, *Asplenium ruta-muraria* (Wall Rue), found on the Lookabout limestone crag; the other is an alien shrub, *Cotoneaster horizontalis* (Wall Cotoneaster), seen on an old limestone quarry face north of the site of the tunnel marked on Figure 1.

Shallow soils develop over horizontal rock surfaces created by quarrying; such soils are colonised by common species of limestone grassland including *Festuca rubra* (Red Fescue), *Thymus praecox* (Wild Thyme), *Linum catharticum* (Fairy Flax), *Briza media* (Quaking Grass), *Helianthemum nummularium* (Common Rock-rose) and *Euphrasia confusa* (Eyebright). All of these were present recently in the tiny, long-abandoned easternmost quarry on The Haw (Fig. 1). Numerous stress-tolerant pioneer species have been found recently on the more extensive floor of the old Haw Bank workings (through which the present access road to Skipton Rock Quarry passes) including *Gentianella amarella* (Autumn Gentian), *Ophrys apifera* (Bee Orchid), *Polygala vulgaris* (Common Milkwort), *Sherardia arvensis* (Field Madder), and *Sedum acre* (Biting Stonecrop); several of these species are discussed individually below. This type of quarry-floor habitat was increased nearby through a recent resumption of quarrying on the southern slope about 100m north-east of Lookabout. Providing that motor-cycle scrambling or illicit "camping" do not come to exert influence, the old quarry floors will long continue to provide conditions suitable for interesting stress-tolerant colonists. One such colonist, possibly still present but not recorded since 1900, is the annual grass *Aira caryophyllea* (Table 1).

Plant Records: Notable Absences, Gains and Losses

In the *Flora of Skipton and District*, Rotheray (1900) chose to specify provenances for some species, especially those regarded as uncommon. All those from the area designated here as "The Haw" are listed in Table 1. Of the 36 species, Rotheray reported that two species had gone, and others have disappeared subsequently. Species discussed

FIGURE 4
Near-vertical bedding on the southern face of the old Skibeden Quarry, on the easternmost hump of The Haw relict (April, 1993).

individually below include a majority from Table I, and others of interest, either through their absence from appropriate habitats, their colonisation of quarry precincts, or their presence as relict indicators of past gardens.

It has been shown above that all of the types of habitat alluded to by Rotheray (1900) are still available on The Haw. Absences of calcicolous species abundant in the Dales and known losses require explanations. The possibility of reintroduction of some species of conservation interest will be considered.

A Notable Absentee from Crags, Quarry Faces and Grassland

One of the characteristic species of limestone crags, old quarry faces and hilly grassland in Craven is *Sesleria albicans* (Blue Moor Grass). It distribution pattern suggests absences from large areas which are climatically and edaphically suitable (Dixon, 1982). The Haw and other small limestone outcrops of the Skipton anticline represent "islands" which this species, with its limited potential for dispersal (Dixon, 1982), may never have reached. Crags could have provided refugia for this slow-growing stress-tolerant grass during post-glacial afforestation, but Lookabout is insignificant and possibly unnatural. From such refugia *S. albicans* would have spread over relatively short distances as a long-lived founder member of grassland communities.

Grassland Species

Anthyllis vulneraria (Kidney Vetch) is a calcicole tolerant of a range of moisture regimes, and was recorded in Yorkshire "In low moist meadows as well as on dry barren limestone soil, but more abundant on the latter" by Baines (1840). It was lost from Hawbank Rock between 1889 and 1900 (see Table 1), was found there in the 1940s by the late Mr J. N. Frankland (*pers. comm.*), but could not be found recently. It is tempting to suggest that control of rabbit populations during the war might be relevant to its temporary presence.

FIGURE 5(a)

FIGURE 5(b)

e Haw photographed from the same spot (a) in about 1933 (source unknown) showing · grassy summit and the valueless 'dark argillaceous limestone and shale' . . . 'in great dding planes*' on the southern face of the post-1856 Skipton Rock Quarry: tree-clothed oil hides a similar face in the oldest workings (Haw Bank Quarry), and (b) in 1995. The ft made in 1960 is evident.* Description based on annotations to a map in The Arthur Raistrick Archive, J. B. Priestley Library, University of Bradford.

An ongoing unpublished experiment in collaboration with Dr J. M. Dixon has shown that mmercially available *A. vulneraria* can survive to produce flowers when sown on a rth-facing spoil slope, but only if shielded from rabbits. Further, when groups of young nts were set out into 1m x 0.25m gaps made in the ancient tussocky pasture relict of he North Hills" Q321, they were attacked by rabbits, overgrown by other species (even en protected from rabbits), and lost completely within two years – despite the reported ccess of *A. vulneraria* elsewhere in "dense vegetation" (Verkaar & Schenkeveld, 1984). propriate conditions for this species appear to have existed only spasmodically on The w.

Brachypodium pinnatum (Tor Grass) was described by Lees (1888) thus: "a species of sture and thickets, rare but locally abundant: follows the Permian tract very closely".

However, one of his records was from "near Hambleton" (which implies the quarried Carboniferous limestone outcrop a few km east of Hawbank Rock). It was found in 1945 by Mr J. N. Frankland (*pers. comm.*), in quantity "Nearly at the top of Hawbank on the grassy slope above the Skipton-Bolton Abbey Road". The same botanist mentioned that "this grass does not grow anywhere [else] on the mountain limestone". The main area of distribution of this calcicolous "worthless grass of neglected open grassland" (Hubbard, 1984) is towards the south of England – suggesting a preference for a low annual rainfall and high summer temperatures; climatic changes now in progress (Elmes & Free, 1994) may render The Haw more hospitable to this undesirable (see Hubbard, 1984), stress-tolerant competitive (Grime, 1979) grass in the future. The population on The Haw may well have been destroyed through improvement of pasture, but two of the species with which it is associated on the Magnesian Limestone (*Origanum vulgare* and *Inula conyza*) are still present together elsewhere on The Haw (see below).

Gentianella amarella (Autumn Gentian) occurs in Yorkshire "on chalk and limestone hills, as well as on low peaty moors" (Baines, 1840). It was recorded on "Hawbank Rock and adjoining pastures" (Rotheray, 1900), and is now abundant, not as a grassland species but as a stress-tolerant ruderal (Grime, 1979) pioneer (see p. 25) of skeletal humic soil, on the floor of the early 19th century workings of Haw Bank Rock Quarry. Pasture improvement has evidently been involved in its local restriction to a pioneer role.

Gentianella campestris (Field Gentian) was recorded from a "hillside, Hawbank Quarry" by Rotheray (1990). It prefers "acid or neutral" soil of "pastures and dunes" (Clapham *et al.* 1987). This record is doubtful (J. N. Frankland *pers. comm.)*; there have been no others.

Inula conyza (Ploughman's Spikenard) occurred in 1994 in the same roadside habitat (see below) as *Origanum vulgare*, a species with which it is associated in "a tall *Bromopsis erecta - Brachypodium pinnatum* dominated sward" on the Magnesian Limestone (Lavin & Wilmore, 1994). It was not recorded from anywhere in the Skipton area by Rotheray, and is here at the northern limit of its range – a limit which may be extended (see above). It exists as a biennial or perennial, but reproduces through seeding, and persists by means of a seed bank. Its germination is inhibited by a leafy canopy (M. J. Fenner, quoted by Grime, 1979); the southerly aspect and the verge-maintenance regime have evidently provided a suitable microclimate and a suitable level of disturbance to allow some regeneration from seed.

Origanum vulgare (Sweet Marjoram) although "common" on "dry sandy or calcareous banks" in Yorkshire (Lees, 1888) was considered worthy of remark by Rotheray, who described a white flowered form from the "Skibeden limekilns" (Fig. 1). No plants could be found recently anywhere on The Haw, except for a very small population of typically pigmented plants in grassy roadside vegetation (with *Inula conyza*) 500m to the east of the old limekiln site, and just outside the field wall (around National Grid intersection SE020530). It is a rhizomatous perennial which regenerates from a large persistent seed bank (Grime, 1979). The roadside community of tall herbs in which *O. vulgare* and *I. conyza* are associated is so unusual locally as to merit conservation – through occasional disturbance!

Species of flushed areas

Dactylorhiza incarnata [= *Orchis latifolia*] (Early Marsh Orchid), was described as very common in Yorkshire, in marshes and moist meadows by Baines (1840). It was found on "Rubbish heaps, Hawbank Rock" during the 19th century, but was not found by J. N. Frankland in the 1940s. The site of those wet spoil heaps is unclear, although two springs on the northern slope of " . . . Haw Bank P318" near National Grid intersection SE0153 (Hambler, 1995) must have fed water into heaps later to be planted with conifers.

Isolepis setacea (Bristle Club-rush), recorded from "Hawbank Rock" by Rotheray (1900), could not be found recently. It has "a scattered and somewhat local distribution throughout West Yorkshire" (Lavin & Wilmore, 1994) where it is typically associated with *Hydrocotyle vulgaris*, another acidophile species, which was found ephemerally in recent

ears on a patch of bare silt by Haw Beck in "The North Hills Q321". An alternative abitat type "among taller herbage in marshy meadows" (Clapham *et al.*, 1987) was resumably once available around Haw Beck, but has been largely destroyed locally, since ne 1880s, through railway construction, culverting and through development of steep spoil eaps along the northern foot of The Haw.

Mentha pulegium (Pennyroyal), "an *RDB2* competitive species of . . . wet places articularly on sandy soil" (Elmes and Free, 1994) has drastically declined countrywide rough land drainage. It was recorded by Rotheray (1900) as an adventive on "Rubbish eaps, Hawbank Quarry". This suggests the site where *Dactylorhiza incarnata* was found ee above). It has always been extremely rare in northern England, being associated with gh (>14.4°C) July mean temperatures. The Haw evidently provided an appropriate icroclimate (on the south-facing slopes of spoil heaps?) during the last part of the 19th entury, and may do so again. It has at least one contemporary station, on disturbed land, ithin 20km of The Haw (Mrs P. Abbott *pers. comm.*).

Parnassia palustris (Grass of Parnassus) was recorded by Rotheray as present on awbank Rock in 1888 but "now gone". The provenance suggests a flushed area, in part of e 18th century pasture "The Haw Field and Haw Bank P318" (Hambler, 1995), rather an either a swampy beckside area or the flushed rubbish heaps (see above) on the hillside. has not been rediscovered in the present century. Like *Primula farinosa* (see below) it is corded in Yorkshire from both wet and dry habitats, e.g. by Baines (1840) "In spongy oggy places . . . On dry magnesian limestone hills", and sometimes the two species occur gether. It is likely that they did so on The Haw, and that they were lost through the same ause – pasture improvement. The loss of *P. palustris* from many 10km squares in Britain erring & Walters, 1982) must be attributable largely to land drainage. This might have een a factor here, although there is still a spring (NE10529) in improved grassland on the orthern slopes of Hawbank (Hambler, 1995).

Primula farinosa (Bird's-eye Primrose) was described by Lees (1888) as "confined to e north west half of the [West] Riding but within that section common". It was found "in e mountains and meadows in the West Riding of Yorkshire; Ray cat., p. 252 (1670). . . . Windsor, Haw Bank [sic] Skipton Rock."; the last record is linked to the period 1855-58 in Lees' (1888) Bibliography. It was also recorded by Rotheray (1900) from awbank; this seems to be a contemporary record, although Rotheray may be referring to e same source as Lees. It has not been found on The Haw, to the author's knowledge, ring the present century.

The absence of the word "Rock" in its provenance leaves open the possibility that rd's-eye Primrose was found in wetland near Haw Beck. It is not confined to uplands as e reference to "a very low and squalid meadow near Knaresborough" by Lees (1888) ggests.

Although *Primula farinosa* is the most widespread member of its genus in the world right Smith *et al.*, 1977), it has a disjunct distribution between and within the rboniferous and Magnesian Limestone outcrops of Britain. It is a characteristic species the *Seslerio-caricetum pulicariae* (p. 26), and stands of this grassland association "occur ncipally on steep south and west facing slopes, where the influence of glacial drift is nimal" (Dixon, 1982). No springs have been recorded on these aspects of Hawbank, but may not always be dependant on such a water supply. It can thrive among limestone ks, in calcareous soils with drifting water regimes and under trees; Miall and Carrington 362) recorded it from "Rocks east of Malham Tarn . . . Mackershaw Wood near Ripon, a dry limestone bank and in marshy fields near Galplay . . .".

Despite its apparent abundance in Yorkshire before the 20th century, Baker (1907) ntioned it in several of his lists of rare plants, and as one of the fifteen "most interesting nts about Skipton . . . ". Samuel Hailstone in Whitaker's (1878) historical work strated how colourful and spectacular it could be: "covering whole meadows with a fine ky colour about Conistone and other parts of Craven". Hailstone waxed enthusiastic: ne British flora cannot boast more beautiful productions than this elegant *Primula* which

adorns the hills and wet pastures . . .". Although the species is described as "locally abundant" in the British Isles by Clapham *et al.* (1987), its meadowland habitat has declined. It would be worthy of reinstatement on The Haw should circumstance permit, and an experiment is in progress to this end.

Valeriana dioica (Marsh Valerian) was recorded from a "Boggy field Hawbank". The most likely site of this once boggy area was where Hawbank met Haw Beck, that is on "The Haw Field and Haw Bank P318" where the railway now curves southward beneath the road (Fig. 1 inset). It was found somewhere on The Haw by Mr J. N. Frankland (*pers. comm.*) in the 1940s, but it has not been found recently.

Species of Nutrient-poor Disturbed Land

Species favoured by disturbance of nutrient-poor habitats where "stress conditions are experienced during the period of growth" have been classified as stress-tolerant ruderals (Grime, 1979). Established as pioneers on disturbed ground, often biennials, facultative perennials, or small geophytes, some (such as the Cowslips p. 33) may be sufficiently competitive to persist even when the vegetation canopy has become closed.

The construction of a tramway into the The Hawbank Quarry was finished in 1794 (Smith & Binns, 1986). In the middle of the following century the tramway passed through a cut and cover tunnel in the earliest part of the workings (Fig. 1) and in 1896 the track was diverted round it (Dickinson, 1995); later the tramway was destroyed and replaced by a tarmacadam road. All this disturbance, and later construction of the present access road (Fig. 1 inset) beside the tramway relict have provided opportunities, over a period of two centuries, for "interesting" stress tolerant ruderal plants to be become established. *Tragopogon pratensis* (Goat's-beard), which is facultatively annual or perennial, is one such species recorded by Rotheray, and is still present along the old track. Others, which have been found at various times, included the three biennial members of the family Boraginacae considered below.

Anchusa officinalis (Alkanet), a perennial, recorded from Hawbank Rock by Rotheray (1900), is both a pioneer of waste heaps and a garden escape. It is discussed further on page 32.

Cynoglossum officinale (Hound's-tongue) is a calcicolous biennial or short lived perennial species of roadsides and waste ground, and of "grassy places and borders of woods on rather dry soils" (Clapham *et al.*, 1987), but is "completely absent from areas above 150m in Great Britain" (de Jong *et al.*, 1990); this upper limit approximates the level of the tramway mentioned above. It was first recorded in Yorkshire in the 18th century and Lees' (1888) list of local records indicates losses with a few reappearances some years later; observations by de Jong *et al.* (1990), however, throw doubt on the likelihood of this species producing a seed bank of buried dormant seeds.

Around the end of the last century *C. officinale* was "very rare within our area" (Lees, 1888). The species is evidently limited in its British distribution by requiring cold winters and warm summers. An inland site east of the Pennines would need to have an atypical microclimate. Despite the large area of disturbed ground produced soon after 1850 as "all the waste and muck was tipped in the old workings at the entrance to the quarry" (Dickinson, 1995), and continuing land disturbance there local botanists have not [re-] recorded this species from Hawbank during the present century. This suggests that climatic fluctuations around its tolerance limits, and probably the development of the Larch plantation in the Hawbank workings (see above) were responsible for its local extinction.

Echium vulgare (Viper's Bugloss), another biennial of dry soils was not recorded in the Skipton district by Rotheray (1900). It was probably not present on The Haw before the middle of this century, although Miall and Carrington (1862) recorded it from Bolton Abbey, about 4km to the east. It is now present along the old tramway and on the post-1960 spoil heaps of Skipton Rock Quarry. Its gradual eastward spread along the haul road from the heaps nearest the quarry works to more recent heaps has been noticed; flowering specimens were observed near the works (SE14534) in 1983, but at least ten years elapsed

fore flowering specimens were seen 700m to the east. Its British distribution is scattered 1 grassy places on light dry soils . . . mainly in the south and east" (Clapham *et al.* 187).

Dipsacus fullonum (Wild Teasel), a biennial, is present sparingly in open vegetation on ound first disturbed around 1856 when "a shallow cutting was made in the northern side the forward face" [of the quarry workings at "'Haw Bank"]; this is near the remains of e bridge which once carried the right-of-way (Fig. 5a) over the cutting.

Reseda luteola (Dryer's Rocket), another biennial of open habitats, is present in Skipton ock Quarry descending into the deepest modern workings, and is known to have been esent for some years in the Hawbank workings.

Polemoneum caeruleum (Jacob's Ladder), a rhizomatous perennial herb, was present in 91 as a single plant, in a "typical [natural] position on the edge of a steep . . . slope down trees", on the route of the old tunnel north of the present Skipton Rock Quarry access ad (Mrs C. A. Johnson *pers. comm.*). It has been sought subsequently, but not found. In ew of the proximity of the find to the remains of Rock Cottage, i.e. >200m distant (p. 33) s possible that it is a previously unnoticed long-established garden escape or "throwout". hatever its origin, it may have been deliberately removed.

Ophrys apifera (Bee Orchid) is a stress-tolerant, ruderal-perennial calcicole dependant on the quarry environment but requiring an absence of disturbance for some years to ow its root-tubers to form. It had been present for many years in open vegetation on the l quarry floor by the access road to Skipton Rock Quarry, and has persisted on a small grazed, grassy roadside embankment nearby.

chidaceae Species of Meadows

mnadenia conopsea (Fragrant Orchid) is a species growing "commonly on calcareous or cumstantial soil in ± species-rich grassland . . ." (Clapham *et al.*, 1987). It was not orded specifically from The Haw by Rotheray (1900), and is described as "a rare and al species" on the Magnesian Limestone in West Yorkshire, where it occurs "in nerally quite small populations" (Lavin & Wilmore, 1994). Two flowering spikes were und in 1994 on grassy quarry screes in the old Hawbank workings.

Listera ovata (Common Twayblade) was recorded "In groves, woods, meadows and stures, frequent" by Baines (1840); and from woods and a railway bank near Skipton, hough not specifically from The Haw, by Rotheray (1900). It is present in a small ntation, on old grassy hummocks of quarry waste, on the southern flank of "The Haw rk L296" (Fig. 6) around NG intersection SE020530, and in the tussocky grassland relict rner (p. 19) of "The North Hills Q321".

Orchis mascula (Early Purple Orchid) was once a common plant of moist meadows and stures in Yorkshire (Baines 1840). It was described by Rotheray (1900) thus: "common, pears annually with pure white flowers on Hawbank Rock". It has not been found ently on The Haw. The loss, soon after Rotheray's book was published, of lime-flushed ssland below a spring-line at around the 525ft (=160m) contour on the northern slope of he Haw Field and Haw Bank P318" through overwhelming spoil heaps (Hambler, 1995), y be significant, as may the "improvement" of relict Haw Bank pastures. Three of its ical associates recorded by Lavin and Wilmore (1994) on the Magnesian Limestone of est Yorkshire, *Carex sylvatica* (Wood Sedge), *Primula veris* (Cowslip) and *Sanicula opaea* (Sanicle), are still present, marginal to the plantation woodland of the heaps.

dgerow Species

mpanula latifolia (Giant Bellflower) is not present on The Haw now. It occurred by cibeden lime quarry in [a] hedge" (Rotheray, 1900). It is a species of woods and lgebanks which is "widely distributed but local in Great Britain" (Clapham *et al.*, 1987) l is one of Baker's (1907) fifteen "most interesting plants about Skipton", as was another cies, *Rubus caesius* (Dewberry), once found by the Skibeden Limekilns. Both were orded by J. N. Frankland (*pers. comm.*) in the 1940s. The Giant Bellflower and *Silene*

FIGURE 6
Part of 'The North Hills Q321' (the lorry is travelling westwards on the A59). The Ash tree is in a tiny grassland relict, with *Primula vulgaris*, of a period before 1850. The small Sycamore/Ash copse is on rubbish from a small pre-1850 quarry – *Primula veris* is a characteristic spoil colonist among the trees. The foreground slope represents a landscaped part of Skibeden Quarry.

vulgaris, another perennial of quarries and hedgerows recorded in 1900, were lost from this vicinity, probably through embankment followed by reclamation afforestation along the A59 road. Dewberry is still present on The Haw among Blackberry bushes north of the point where the right-of-way (Fig. 5a) crosses the Skipton Rock Quarry access road. *Clinopodium vulgare* (Wild Basil), a calcicolous herb with a discontinuous distribution in "hedgerows, wood borders and scrubby grassland" (Stace, 1991) is present in such a habitat near the remains of the old tramway tunnel (Mrs C. A. Johnson *pers. comm.*).

Garden Escapes and Garden Relict Species
Several species presumed to have originated in gardens were found on The Haw around the end of the last century and were considered sufficiently interesting to be recorded by Rotheray at the beginning of the century (Table 1).

Hesperis matronalis (Dame's Violet) is a common, more-or-less naturalised escape in waste places (Stace 1991); it persisted on The Haw at least until the 1940s (J. N. Frankland, *pers. comm.*), and was present (in 1994) in roadside vegetation only a few hundred metres from Hawbank – but on the opposite side of Skibeden Beck.

Fragaria moschata (Hautbois Strawberry), once recorded from the "tramway side to [sic] Hawbank Rock" (Rotheray 1900), has not been noted subsequently either on or near The Haw.

Anchusa officinalis (Alkanet), mentioned in relation to other Boraginaceae above, was recorded by Rotheray (1900) not only from Hawbank Rock but from waste ground around the railway; it is described by Stace (1991) as a "rather impermanent escape on rough and waste ground and tips" in the British Isles; the garden of "Rock Cottage" (Hambler, 1995)

ms a likely source for any Hawbank Rock population, but the species has, apparently, persisted.

Some garden relic species *have* been found in the immediate vicinity of the Rock ttage remains. These are *Hypericum calycinum* (Rose of Sharon), and *Centaurea ntana* (Perennial Cornflower), which have survived from a garden abandoned over 40 rs ago.

Cotoneaster horizontalis (Wall Cotoneaster) has been identified (at a distance!) about 0m north east of the cottage, but nearer to some temporary quarry buildings (shown on six inch OS map of 1854). A single specimen grows high up on the only south-facing nestone quarry face on The Haw.

Relict borders around an office site at Far Skibeden abandoned in 1991 still contain rden shrubs (including *Cornus alba* and *Berberis thunbergii*), trees including *upressocyparis leylandii*, and herbaceous plants including *Narcissus* (Daffodil) cultivars, d *Lysimachia punctata* (Dotted Loosestrife).

eliberately Introduced Garden Plants or "Garden Throwouts"

he Haw has been particularly prone to receipt of perennial herbaceous garden material, her through dumping or perhaps by deliberate "unofficial" attempts to improve the pearance of the quarried area. One example, noticed in 1995, was the appearance of *rcissus* agg. (Daffodil) cultivars on the steep north-facing slope of the spoil heap which vers the north-eastern corner of "The Haw Park L2966". The annual appearance, noticed roughout the past decade, of *Meconopsis cambrica* (Welsh Poppy) on the same slope ay also be the result of deliberate introduction.

pecies of recently rehabilitated areas

eclamation during the past ten years has been evident on new embankments and other rips of land bordering the A59 Skipton/Harrogate road east of Skibeden; this has been in e form of seeding with grasses, and dense planting of trees and shrubs protected from bbits by enclosures. Native grasses and woody species are present, and will restore to he Haw some of its earlier wooded character.

On the northern side of "The Haw Park L296" very steep *ca.* 30° spoil (east of NG line 01) is partly wooded with small Sycamore and Hazel trees as a result of planting during e second half of the present century. Further east, footing "The North Hills Q321", less eep slopes of spoil, only partly covering the original land surface (p. 19), were seeded in 984 with a mixture of native grassland plants including *Agrostis stolonifera* (Creeping ent) and a variety of the stress-tolerant competitor *Festuca rubra* (Red Fescue) which was xpected to become dominant in the long term. Native trees and shrubs were also planted.

The attentions of rabbits have been monitored, and although part of their influence has een beneficial in increasing biological activity and diversity on and under the spoil surface Dixon & Hambler, 1993), a less beneficial influence has been to damage woody troductions and to remove all potential inflorescences from herbs – including not only *nthyllis vulneraria* (Kidney Vetch) (see p. 26) but rabbit – resistant species such as *Lotus orniculatus* Bird's-foot Trefoil, *Trifolium repens* (White Clover) and *Achillea millefolium* Yarrow) sown with the grass and even from immigrant species usually avoided, notably *rimula veris* (Cowslip) (Hambler *et al.*, 1995). An exclosure experiment is in progress to ssess the magnitude of the rabbits' deleterious influence on individual species and on the egetation as a whole.

Prior to reclamation, the two most abundant pioneer colonists of spoil embankments ave been the drought resistant evergreen *Sedum acre* (Biting Stonecrop) on south-facing opes (along the A59 road), and *Fragaria vesca* (Wild Strawberry) on the north-facing opes.

berrant plants

wo species populations described by Rotheray (1900) – *Origanum vulgare* (from

Skibeden Limekilns) and *Orchis mascula* (from Hawbank Rock) – were white-flowered or had a white-flowered component. A solitary magenta-flowered umbellate *Primula* specimen (with a short footstalk) was recently found among typical Primroses in the light Ash/Hawthorn copse near Lookabout by Mr E. A. Higson. It is likely to be a *Primula vulgaris* variant, as "it is not uncommon to find these 'bunch Primroses' in the wild" (Mrs Barbara Shaw *pers. comm.*). No *Primula* cultivars have been found in the vicinity.

Undesirable plants

Inevitably opinions will differ as to what species it is "desirable" to plant or to retain. Some of the author's own opinions regarding alien trees are self-evident! Further, it may be difficult or impossible to retain some attractive, native seral species (orchids, etc.) without *ad hoc*. long-term maintenance. One spontaneous and most unwelcome addition to the flora of The Haw discovered in 1995 in the old Haw Bank workings is the almost ineradicable, aggressive colonist *Fallopia japonica* (Japanese Knotweed).

Conclusions

The Haw, despite and because of its long history of human exploitation, has provided a wide variety of transient habitats for native (sometimes rare) herbaceous plants, and (by implication) for many animal species. Construction of a railway towards the end of the 19th century and recent culverting destroyed most of the available wetland along its northern foot; improvement of such hill pasture as has escaped quarrying. since the beginning of the century has reduced its potential species-richness. It is these human influences, together with the meeting of a perceived need for the screens to hide the "deep and awful chasm" described by Bailey (1852) which have reduced the potential of the north-facing Haw Bank slope with its 19th century spoil heaps as a refuge for native trees and "interesting" herbs. Unfortunately, until very recently, all trees planted on The Haw have been aliens, including Sycamore, "a tree which no responsible person should plant without considering the long term consequences" (Rackham 1986).

Quarrying has destroyed much ancient grassland and scrub on The Haw, including lime-flushed areas on the rocky Hawbank, but continues to create ephemeral habitats for interesting early-seral species. Unfortunately, 19th century reclamation was unsympathetic to a stress-tolerant calcicolous flora – flushed "rubbish", rich in orchids and hydrophile herbs was afforested. In an area hemmed-in by neutral grassland and gritstone hills encouragement of a species-rich, predominantly calcicolous flora comprising both herbaceous and woody species might be considered fitting whenever rehabilitation of land is needed. In view of a comment by Rackham (1986) concerning endangered tree species, Hazel might be the most appropriate component, with Ash as a companion, in any reclamation woodland. However, when waste disposal sites such as that now in operation in the Skibeden quarries are eventually capped and planted, careful attention must be paid to the potential rooting-depth of any introductions, or of self-sown trees far into the future.

Quarrying has provided still water habitats, in the form of small pools (p. 23), not previously available on The Haw. The "dub", formed during periods when that part of the working Skipton Rock Quarry now east of NG line E015 is not pumped out, could provide alkaline, clear-water aquatic habitats in the future. Such bodies of water are rare; they accumulate assemblages of uncommon plants, and are therefore potentially valuable after quarrying ceases, for conservation, and as amenity resources e.g. for angling (cf. the dub at Smellows Quarry – NG SD943527).

Floristic links between the Carboniferous and Magnesian Limestones have been suggested through the occurrence of several rare species on The Haw. When quarrying and landfill have ceased, the remains of the hill could thus have considerable potential as a site of both scientific and conservation interest. This account shows that The Haw, partly as a result of quarrying, has provided niches for a number of species at the extremes of their climatic ranges. The prediction that within 50-100 years the UK might be generally 2°C warmer (Elmes & Free, 1994) makes such a site of particular ecological interest. Recorded

ntroductions or re-introductions of less-common and endangered plants native to Craven would, in the opinion of the author, be a legitimate aim.

UMMARY

he Haw near Skipton has been subjected to gross changes in its topography, and to nodified land-use during the past two centuries. Related changes in both vegetation and ora have been inferred from literature and from recent observation, and reasons for the resence or absence of "interesting" plant species have been suggested. Quarrying has rovided habitats for some of these species – railway work, pasture improvement, and indscape "reclamation" have tended to reduce the availability of such habitats.

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BOOK REVIEWS

Alien Plants of the British Isles by **E. J. Clement** and **M. C. Foster.** Pp. xviii + 590. Botanical Society of the British Isles, London. 1994, £15.00. Available from: BSBI Publications, Green Acre, Wood Lane, Oundle, Peterborough PE8 5TP.

This work provides a mine of information of inestimable value to those studying the British flora, in that it covers not only all those alien plants included in C. A. Stace's *New Flora of the British Isles* (1991, Cambridge University Press), but also all other alien species gleaned from 1,287 published sources and 86 correspondents.

The word "alien" is used in a broad sense to include all those plants, thought to have arrived via human activities, often referred to as "adventives', "casuals', "ephemerals", "exotics" and "introductions", which have or have not become established in the British Isles. A catalogue of *c.* 4200 taxa (excluding grasses), 885 species of which have become established, forms the main body of the text; each plant entry contains succinct yet detailed information on means of introduction, frequency, status and distribution, origin and published sources, and many entries provide locations of voucher specimens. The systematic catalogue (399 pp.) is complemented by a comprehensive and well designed alphabetic index (145 pp.) of Latin and English names, including synonyms, compiled by R. G. Ellis.

All-in-all, an invaluable compendium of data, establishing a baseline on which to evaluate accurately the ever-changing nature of our flora, whereby indigenous species are increasingly usurped by the insidious invasion of alien plants.

MRDS

ld Guide to tho Palms of the Americas by **Andrew Henderson, Gloria Galeano** and **drigo Bernal**. Pp. ix + 353, also 64 pages of full colour plates. Princeton University ss. 1995. £50.00.

s excellently produced guide is a model of its kind, not only in providing keys and criptions for field taxonomists but also in containing a wealth of information on the logy, distribution and economic uses of this important group of tropical and subtropical nts.

The area covered by this work includes USA states bordering the Caribbean, the ibbean islands, Mexico, Central America, and Brazil and neighbouring countries of ith America. This region contains many sensitive ecosystems, particularly tropical rain ests, which are highly vulnerable to increasing human disturbance and exploitation. On other hand, the conspicuous exotic features of palms have ensured them worldwide oularity: their introduction into gardens, parks and palm houses reflects a desire to create east some element of tropical landscape there.

Quite clearly, a detailed knowledge of this fascinating group of plants is timely. rkshire naturalists will derive pleasure from the knowledge that one of our famous decessors, Richard Spruce (1817-1893), who spent fifteen years of his life as botanist l explorer of the Amazon and Andes, was responsible for one of the first major onomic works on Amazonian palms, published in the *Journal of the Linnean Society, tany* **11**: 65-183 (1869).

MRDS

lustrial Ecology and Global Change edited by **R. Socolow, C. Andrews, F. Berkhout** l **V. Thomas**. Pp. xxix + 500, with numerous line drawings and tables. CUP. 1994. 5.00 hardback.

ecies Diversity in Space and Time by **Michael L. Rosenzweig**. Pp. xxi + 436, with merous line drawings. CUP. 1995. £50.00 hardback.

anaging Habitats for Conservation edited by **William J. Sutherland** and **David A. ll**. Pp. xi + 399, with numerous line drawings & b/w plates, also 8 pages of full colour tes. CUP. 1995. £17.95 paperback.

ith these three books, Cambridge University Press maintain their excellent record as blishers of key ecological works.

Industrial Ecology and Global Change is a major outcome of the Global Change stitute meeting held in Colorado in July 1992. Numerous authors contribute chapters der five headings: (1) vulnerability and adaptation, (2) the grand cycles: disruption and pair, (3) toxics and the environment, (4) industrial ecology in firms, and (5) industrial ology in policy-making. The individual contributions are effectively held together by ilful editorial work which includes the provision of an overview, introductory matter to ch of the above headings, an end piece and a useful index (a feature all too often lacking edited conference proceedings). This is an important work on a subject that cannot be nored: the repercussions of such environmental changes have local and regional plications, as well as a global impact, as yet not fully addressed by biologists.

Species Diversity in Space and Time provides a valuable text on ecological dynamics and important aid to those studying biodiversity – a topic currently receiving considerable edia attention; but without a knowledge of taxonomy, a subject now little studied in gher education throughout Europe, how can diversity be measured? The well written (and adable) text, complemented throughout by illustrative (mainly graphical) work, provides solid foundation from which to determine and interpret the capacity of particular habitats d of areas of different sizes to accommodate certain numbers of species and to evaluate

change in them over time. As the author appropriately quotes on his pre-title page "As evolutionary ecologists race to understand biodiversity before it is too late, this book will help set the agenda for diversity research into the next century".

Managing Habitats for Conservation provides a valuable guide to the management of British habitats, with individual chapters by different authors devoted to (1) coastal habitats, (2) rivers, canals and dykes, (3) waterbodies, (4) reedbeds, fens and acid bogs, (5) grasslands, (6) farmland, (7) lowland heathland, (8) upland moors and heaths, (9) woodland and scrub, and (10) urban areas. Additional chapters are provided on the principles of ecological management, site management planning, and access. Naturally, it would be difficult to encompass all practical aspects of habitat management within such a volume, but it is clear from the pragmatic approach to conservation that such methodology as is advocated is based on both scientific principles and on the practical experience of the contributors. The text is well complemented by line drawings and plates to illustrate these skills.

MRDS

The Craft of Natural Dyeing: Glowing Colours from the Plant World by **Jenny Dean**. Pp. 64, with full colour illustrations. Search Press/Burns & Oates, Tunbridge Wells. 1994. £6.95 paperback.

This is a very attractive introduction to vegetable dyeing, full of coloured illustrations that take the reader step by step through the basic methods and show the results obtained. The use of grammes rather than ounces without a conversion table will not appeal to the dyer of more mature years having only a weighing machine. Each dye plant is described. Lichens are given such brief mention that a novice would be unlikely to employ them successfully. Perhaps this is no bad thing in terms of conservation. I particularly liked the chapter describing how to grow dye plants in your own back garden. It is a pity that the author does not include a list of other books, such as *Craft of the Dyer* by Karen Casselman (Dover Publications, New York 1993), to which a novice dyer might graduate. At around £7 for 60 pages of text, Jenny Dean's book is not cheap but the high quality coloured illustrations and very readable text will appeal to readers.

DHSR

Darwin's Laboratory: Evolutionary Theory and Natural History in the Pacific edited by **R. MacLeod** and **P. F. Rehbock**. Pp x + 540, with 16 figures. University of Hawai'i Press, Honolulu. 1994 . $45.00.

The title of this book is perhaps a little deceptive. If the Pacific basin was indeed Charles Darwin's "laboratory" – and the concept is a good one – this account is largely of happenings in the laboratory after he had left. In their introduction the editors say (p. 6): "Regrettably, the literature of Darwin and Darwinism in the Pacific is in a very early state." This may be the case, but the time that Darwin spent on some of the Pacific islands, in New Zealand and Australia has in fact been quite thoroughly documented, although this work is not very fully reviewed here. There is little or nothing, for example, on Darwin's attendance at an Aboriginal corroboree, his descriptions of the customs of Maoris in New Zealand, or his climb into the interior mountains of Tahiti. Exceptions are a careful entwining of the work of Darwin and that of his long-time American correspondent, James Dwight Dana, in a well-written Chapter 1 by D. R. Stoddart, entitled "This coral episode" and some mention of the Tahitian people in Janet Browne's "Missionaries and the Human Mind" (Chapter 9). The former is a particularly appropriate essay, as it was the "coral reef theory", the notion that fringing reefs, barrier reefs and atolls formed a continuous series, that represented Darwin's first flirtation with the idea of gradual change throughout time.

The book is, however, an outstanding contribution to the study of Darwin's legacy in the Pacific area, the way in which successive generations of scientists attempted to apply some

Darwin's ideas, as set out in *On the Origin of Species, The Descent of Man, The* *ression of the Emotions In Man and Animals*, and elsewhere, in interpreting the plants animals, and particularly, the peoples, of the Pacific. Of particular interest are Chapter Darwin's Biogeography and the Oceanic Islands of the Central Pacific, 1859-1909" by Alison Kay, and Chapter 3, Jane Camerini's "Evolution, Biogeography and Maps: an y History of Wallace's Line".

slightly different approach is shown in Janet Garber's "Darwin's Correspondents in Pacific: through the Looking Glass to the Antipodes", in Chapter 6. This carefully lyses Darwin's network of correspondents – in Australia, New Zealand, Hawai'i, South erica, the East Indies – describing how they fed information and specimens to him, and v they in turn were influenced by his ideas.

he work concludes with a collection of four chapters (13-16) on "Social Darwinisms". ial Darwinism may be defined in terms of attempts that have been made to apply win's ideas, particularly that of struggle between races, into socio-economic and itical practice: it was an important doctrine in the late 19th and early 20th century. The ral form is used to emphasise that the manner of the transfer has been different in erent locations and at different times. Most examples are taken from Australia (Chapter 15), and New Zealand (14) but instances from Hawai'i and Japan are included in the l chapter. (There is, alas, no concluding section binding the various themes together.)

The book is excellently produced, having a very full "scholarly apparatus" of notes and liographic references for each chapter, a detailed index, and a short biographical ement concerning each of the 19 contributors.

PHA

er books received

e Correspondence of Charles Darwin. Volume 9. 1861. Edited by **Frederick rkhardt, Duncan M. Porter, Joy Harvey** and **Marsha Richmond**. Pp. xxxvi + 609. h 9 b/w plates. Cambridge University Press. 1994. £40.00.

est volume in this authoritative work – a model of its kind – which covers a particularly y and productive year in Darwin's life; see *Naturalist* **118**: 16 (1993) and earlier for iews of previous volumes.

arles Darwin's Letters. A Selection 1825-1859. Edited by **Frederick Burkhardt.** Pp. /i + 249, with 1 b/w plate & illustrated endpapers. Cambridge University Press. 1996. 4.95 hardback.

those unable to afford the above-mentioned monumental work, one of its editors has vided a selection of important and fascinating letters which give us an insight, through ly experience, scientific observations, personal concerns and friendships, into one of the jor figures in the history of science.

e Oxford Book of Creature edited by **Fleur Adcock** and **Jacqueline Simms.** Pp. xii + 7. Oxford University Press. 1995. £17.99 hardback.

fascinating and sometimes amusing selection of prose and poetry from the pens of ateur and professional naturalists, philosophers, explorers, diarists and novelists, as well poets, from many countries.

Plants and their Names. A Concise Dictionary by **Roger Hyam** and **Richard Pankhurst**. Pp. x + 545. Oxford University Press. 1995. £14.99 hardback.

A compact but highly informative botanical aid, providing not only a valuable reference source to *c*.16,000 scientific and vernacular plant names, but also information on folk-lore, economic use, geographical distribution, etc. to please the browser.

Index to Clive Stace's *New Flora of tho British Isles* by **R. Gwynn Ellis.** Pp. ii + 110. 1993. National Museum of Wales, Cathays Park, Cardiff CFl 3NP. £5.00 paperback (plus 70p postage & packing).

A detailed index to at least species level, with extensive synonymy, sadly lacking from Stace's otherwise remarkable *Flora* – see *Naturalist* **117**: 112 (1992).

A Natural History of the Hawaiian Islands. Selected Readings II. Edited by **E. Alison Kay**. Pp. xii + 520. University of Hawaii Press. 1995. $24.95 paperback.

A second selection of previously published key papers on island natural history. many of course paying particular attention to endemism. The reasonable price of this volume is due to the facsimile presentation of the original papers, but additional textual apparatus and commentary would have been useful.

The Natural History of Puget Sound Country by **Arthur R. Kruckeberg**. Pp. xxiv + 469, with numerous diagrams, maps & b/w plates. University of Washington Press. 1995. $34.95 paperback.

A lavishly illustrated and scholarly work describing the impact of both natural influences and human impact, past and present, on a diverse landscape centred upon major water bodies. Biologists and conservationists will find much to delight and stimulate them in this work.

Borneo Log. The Struggle for Sarawak's Forests by **William W. Bevis**. Pp. x + 245, with b/w illustrations. University of Washington Press. 1995. $19.95 hardback.

Although essentially a book on the environmental politics of a faraway country, this thought-provoking narrative on the unnecesary destruction of rainforest and its impact on the lives of the native population deserves worldwide readership.

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

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THE HAUNTS OF THE HAIRY CANARY

PETER SKIDMORE

Presidential Address to The Yorkshire Naturalists' Union, York, December 2 1995

The "Hairy Canary", *Phaonia jaroschewskii*, is one of our rarest British Muscid flies, for which the British headquarters are Thorne and Hatfield Moors. Peatlands have been the subject of intensive, nationwide field surveys during the past decade and this fly is restricted to lowland raised mires (Skidmore 1985). Of some one hundred thousand Muscids collected by pitfall, water and Malaise trapping exercises throughout the United Kingdom over this period, and identified by myself and Dr A. C. Pont, former Muscid specialist at the Natural History Museum in London, some two hundred specimens belonged to this species. All but one male were from Thorne and Hatfield Moors.

I first became aware of Thorne and Hatfield Moors when I joined the Manchester Entomological Society in 1950 (Skidmore 1992), and when in 1954 I joined the Manchester biological supplies firm of Flatters & Garnett Ltd., I learnt of a close friend of Wilfred Garnett, one William Bunting of Thorne. Sharing Wilfred's interest in aquatic life, he was showing that, in terms of the water beetle fauna, Thorne Moor was second to none in the United Kingdom (Bunting, 1954a,b, 1955a,b).

In June 1965 I moved to Doncaster and came to have first-hand knowledge of Thorne and Hatfield Moors, and William Bunting.

Without doubt, were it not for William Bunting, these moors would have been completely destroyed during the past 40 years, so any discussion of these localities should acknowledge this remarkable man. In her masterly account of Thorne Moor and of his involvement in its protection, Caufield (1991) succinctly describes and dedicates the book "to William Bunting, Naturalist, Pamphleteer, Rebel, bad-tempered old sod, and inspiration". A brusque Barnsley man, he possessed a range of amazing qualities which were gained, or more likely honed to perfection, through service with the International Brigade during the Spanish Civil War and later with the Partisans in former Jugoslavia. After the war, these talents were turned to the cause of Wildlife Conservation and the protection of Human Rights. He was the bane of money-grabbing developers, proud academics and faceless bureaucrats, and was recognised in the highest echelons of the legal profession as the authority on Common Law in Britain. Whether in the courtroom, the scientific or public meeting, or the Public Inquiry, his approach relied on resolute tenacity of purpose, a razor-sharp intellect, brilliant tactics and a refusal to consider compromise, or to fight real battles according to Queensbury rules. As Caufield (1991) pointed out, his often outrageously abrasive manner was a deliberate test of one's commitment to the cause. Likewise his barrage of astonishing facts and deliberate misinformation tested the metal of his entourage, and, when used in the courtroom, would leave his learned adversaries totally bewildered. In such hazardous situations, barristers, once wrong-footed, would fall like ninepins under Bunting's lethal onslaught. Once down, their incompetence would be highlighted for all to see, and their reputation pulverised. Inevitably, Bunting made far more enemies than friends, but those privileged to gain the latter status knew him to be a person of total sincerity and integrity, boundless generosity and great warmth. He also possessed the unexpected quality of bringing out the best in his co-workers. After a long and distressing illness, he finally passed away in early 1995. Whilst no-one could step into his shoes, his spirit certainly lives on in those he inspired, and through whom they share a common bond.

It was in April 1969 that, through Bunting, I became involved in the battle for Thorne Moor (Skidmore, 1970). Thus began a sustained and often unnerving campaign, in which lead often flew over Thorne Moor as peat-diggers attempted to hound visitors from the moor. Co-operation with Bunting inevitably involved a degree of isolation from mainstream naturalists who were outraged or intimidated by his manner, and incredulous of

his scientific assertions. I recall the total disbelief with which his claims regarding the occurrence on Thorne Moors of such creatures as the Harvest Mouse and the ground-beetle *Dromius longiceps* were met, until they were discovered by others (Howes, 1973a,b; Heaver & Eversham, 1991).

With Bunting's departure from the arena about 1983, as a result of his increasing infirmity, developments took a surprising turn. Predictably, peat-extraction rates massively increased as Fisons introduced peat-milling to both moors, but their actions precipitated increased opposition. That they officially intended total destruction of the moors was clearly inferred in Caufield (1991), who quotes the company's Thorne Moor operation manager, Donal Egan, as saying "Fisons were about the last to adopt surface-milling. If we had been earlier, we might not have a problem about Thorne Moors, because it wouldn't be worth fighting for." The visual impact of these moors reduced by peat-milling to vast brown unvegetated deserts stirred even the faintest hearts, and a Buntingesque spirit re-asserted itself. The newly formed, and initially somewhat timid Thorne and Hatfield Moors Conservation Forum was galvanised into action, along with other bodies like the Royal Society for the Protection of Birds and the Yorkshire Wildlife Trust. Friends of the Earth joined in and a full-blooded, media-wide campaign entitled "For Peat's Sake" was on the road. Shaken by the furore, and under increasing economic pressure from the parent company (Caufield, 1991), Fisons Horticultural plc. drew up, and in early 1992 published, but did not sign, an agreement with English Nature. This stated that all worked-out areas on both moors would eventually be given to English Nature for restoration to peat-bog, whilst all currently vegetated areas would be given immediately to that body. Once published, and outside the public gaze, there followed a period during which the company sought to modify less palatable parts of the agreement before it was finally signed by Levington Horticultural plc. in 1994. The final terms are not apparently for public release, either by English Nature or the company, and hence perhaps differ greatly from those published in 1992. If similar however to the terms publicised in 1992, they give some cause for guarded optimism.

A most valuable spin-off of the years of campaigning has been the vast assemblage of data on all aspects of the moors. The main outlet for the dissemination of this information, namely Thorne and Hatfield Moors Papers (see References), is the journal of the Thorne and Hatfield Moors Conservation Forum. The body has also been instrumental in organising field survey work, like the 1991 Invertebrate Survey (Heaver & Eversham, 1991), which was undertaken in co-operation with Fisons Horticultural plc., English Nature, The Royal Society for the Protection of Birds and the Yorkshire Wildlife Trust. Most recent invertebrate surveys throughout the United Kingdom have involved the use of pitfall and water traps. These techniques are vastly preferable to the traditional sweeping methods, since they more nearly reflect the real world and, being replicable, allow for valid comparison of results from different habitats or localities. By such means vast data sources are available to help in our understanding of the ecological requirements of numerous species.

With some guarantee of future protection, it is gratifying to report that today, after 30 years of devastation by peat-extraction, these moors are still surprisingly rich. They have retained a wealth of rare elements, including endemic insects known from nowhere else in Britain, and new species are still being discovered. During a short survey into the habitat of the "Hairy Canary" this summer I found another fly on Thorne Moor which is only otherwise known in the Palaearctic region from Swedish Lapland.

The geology and development of the moors, and their human history, are discussed by Limbert (1987). Peat was of course a traditional fuel since earliest times, and Thorne Moor was a major source of turves for the monks of Selby Abbey during medieval times. More recently, other uses were found for peat, notably as litter for animals (Limbert, 1987), and for the horticultural industry. Recognising the value of *Sphagnum* peat in the cultivation of ericaceous shrubs, William Casson of Thorne established a nursery on the moor edge for the commercial raising of these plants in the early 19th century (Limbert 1991). Indeed, the

hododendrons on the western side of Thorne Moor and the now much reduced *Kalmia ıgustifolium* colony were escapees from Casson's garden.

The 19th century closed with a mushrooming of commercial peat-extraction on Thorne loors, the appalling devastation from which was clearly recorded by visiting naturalists ‿imbert 1989a, 1989b, Skidmore 1970). Nevertheless, as long as the traditional manual eat-digging techniques (Limbert 1987) were used, damage to the moors was less serious its long-term ecological impact, since biota were able to circulate around the moors as ıt areas became available for re-colonisation. However, with the introduction of peat-illing by Fisons Horticultural plc. during the 1980s, this changed and total habitat estruction commenced.

The Peat Campaign "For Peat's Sake", which finally forced Fisons in 1992 to table a sponsible agreement in their negotiations with English Nature, was a three-pronged tack based on archaeological, ecological and public access concerns. The archaeological pect arose from the recognition that a major environmental archive was being destroyed.

EATLANDS AS AN ENVIRONMENTAL ARCHIVE

ırough palaeoentomology our knowledge of a region can long predate human archival cords, but this requires that undisturbed, organically rich sediments, covering a long me-span, are available for study (Buckland, 1976; Elias, 1994). The fallacious claim that atland habitats can be recreated cuts no ice in this argument, since it is the stratified peat self, laid down over centuries, which tells the story. In this context, sites like Thorne and atfield Moors are seen as priceless environmental archives, and their commercial struction is seen as an outrageous sacrilege (Buckland, 1991; Buckland *et al.*, 1994). The atfield Chase horizons beneath the peat tell us that in early postglacial times the ground-eetle *Diachila arctica* occurred commonly on the tundra here, indicating a high subarctic imate (Buckland, 1982). Much later virgin oak and pine forests covered this area, as dicated by such beetles as *Rhyssodes sulcatus*, a classic "Urwalt relict", which is now most extinct in Europe. Many other beetles (Buckland, 1979) and some ant species 'ollingwood & Hughes, 1991) which no longer occur in Britain also inhabited this forest d attest to a rich insect fauna unknown in Europe today. But humans were already aking inroads with track-construction and "primitive" slash and burn agriculture uckland, 1979). Forest-clearance in the higher Don catchment caused increased surface n-off and erosion, and led to flooding across Hatfield Chase (Buckland, *in press*). With ater tables rising and streams traversing the forest floor, indicated by subfossil larval ead-capsules of the crane-fly *Pedicia rivosa* (Skidmore, 1995), peat-bog started to form.

Gradually *Sphagnum* growth swamped the forests and open bog developed with tensive carpets of Cranberries and inundated *Eriophorum* swards, populated by swarms the reed-beetle *Plateumaris discolor* (Buckland, 1979). The fact that this beetle no ıger occurs on these moors indicates that a massive decline in wet *Eriophorum* bog at me time brought about the local extinction of this usually ubiquitous peat-bog species.

ATLANDS AS AN ECOLOGICAL SANCTUARY

though Thorne and Hatfield Moors have ceased to exhibit the structural features of ıssic raised lowland mires, such as the peat dome with peripheral carrland merging into caline fen, remnants of these habitats remain, and recent survey work has served to entify their respective insect faunas. A brief discussion of some of these habitat types llows.

Old peat-canals. The richest areas of Thorne Moor in terms of the peat-bog flora are the l Dutch canals which form the core of the National Nature Reserve. Cut around the turn the century when some adjacent areas of bog were still in their pristine state, these nals formed a reservoir for colonisation of declining species as peat-extraction spread. earby stood Scheuchzeria Well where Appleby saw the Rannoch Rush which gave the ell its name (Skidmore, 1972). Lees (1888) claimed that the plant had disappeared by the 80s, but two independent sources known to the writer suggest that it was seen during the

1940s in the Old Canals area by Dr S. Rowlands of Doncaster. Here are found such plants as *Osmunda, Drosera rotundifolia, Andromeda, Vaccinium oxycoccus, Schoenoplectus tabernaemontani, Cladium, Potentilla palustris, Utricularia vulgaris* etc. On areas of *Sphagnum* and bare wet peat such scarce ground beetles as *Carabus nitens* and *Agonum sexpunctatum* and *A. ericeti* have appeared, whilst on the drier banks Common Lizards and Adders are frequently seen. Formerly *Myrica gale* occurred sparingly here too, but this was much commoner on Hatfield Moor before peat-milling operations there destroyed over 80 per cent of the entire moor surface.

2. **Cotton-grass bogs.** To the untrained eye, the moors include vast areas of almost uniform appearance, such as the large areas covered in botanically poor *Eriophorum* bog. The *Eriophorum* itself is the host plant for the Large Heath butterfly *Coenonympha tullia*, here at its south-eastern limit in Britain (Skidmore, 1983a; Sutton & Beaumont, 1989; Rimington, 1992) and the Haworths Minor moth *Celaena haworthii*, named after the famous Hull lepidopterist Adrian Haworth. The wetter parts provide nesting and feeding areas for Snipe and Teal (Roworth, 1992), and large populations of the dragonfly *Libellula quadrimaculata*. The pools teem with aquatic insects, including the nationally rare *Acilius canaliculatus*, and areas of wet, exposed peat on pool edges, or between the *Eriophorum* tussocks swarm with flies and beetles, including the ground beetle *Bembidion humerale* and the pill-beetle *Curimposis nigrita*, both of which occur nowhere else in Britain (Skidmore, 1983b; Heaver & Eversham, 1991).

3. ***Molinia* beds.** *Molina coerulea* is a common dominant in many parts of the moors and beds of this grass provide the main habitat of the scarce Bog Bush-cricket *Metrioptera brachyptera* (Limbert 1986) and the uncommon fly *Opomyza lineatopunctata*. Recent work however suggests that a very much rarer insect, the ephydrid fly *Eutaenionotum guttipennis* var. *olivaceum* may be associated with this grass. Described from a single specimen taken near Berlin over 90 years ago, and apparently lost during the last war, this fly is currently known only from specimens collected recently on Hatfield and Thorne Moors. The type form *guttipennis* is a rare Holarctic subarctic species (Skidmore, *in press*).

4. **Bracken areas**. In the generally drier areas of the moors, huge areas are covered by *Pteris* and these, like the *Eriophorum* beds, are commonly viewed as ecological wastes unworthy of conservation. However, in a permanently damp patch of bare peat surrounded mainly by Bracken on Hatfield Moor, the 1990-91 survey revealed the presence of more than 350 species of insects, including the three local Red Data book specialities *Bembidion humerale, Curimposis nigrita* and the "Hairy Canary fly" *Phaonia jaroschewskii*. In contrast, only six vascular plant species were present (i.e. *Pteris, Calluna, Eriophorum, Erica, Betula* and *Molinia*). These results, from an area of perhaps 25 square yards, highlight the fallacy of assessing the ecological value of sites, or the viability of habitat restoration schemes (Key, 1991), on purely botanical grounds. Regarding the existence of permanently damp patches on the peat surface of Hatfield Moor, it was shown by members of the Doncaster Naturalists' Society during 1991-92 that such areas occurred where the summits of water domes in the peat approached or reached the surface. Atop another such dome, colonies of the uncommon crane-fly *Limnophila pulchella* and the empid fly *Empis verralli* were found. Although classic peat-bog species, neither has yet been taken on Thorne Moor. The areas of unbroken Bracken cover are also valuable in providing the breeding sites of the nationally important colonies of Nightjar (Limbert *et al.*, 1986), and of the rapidly declining Adder (Howes, 1973, 1988).

5. **Peripheral woodland.** In an undisturbed raised mire, there is usually a marginal area of woodland, dominated by *Betula* on the inner perimeter, and *Salix/Alnus* carr, often merging into alkaline fen, on the outer. Human interference has disturbed this zonation on Thorne and Hatfield Moors, but elements of the characteristic communities remain. Presumably the Nightingale was originally a member of the peripheral woodland community here, but today the favoured habitat appears to be in the dense growths of *Rhododendron* on the western edge of Thorne Moors.

Today, birch dominates large areas of the moors and some clearance is currently

underway. Whilst a degree of control is clearly necessary, birch woodland is a vital and natural part of the moorland ecosystem and its total eradication would be highly undesirable, as it supports a rich fauna. Areas of moor with scattered birches provide the main habitat for Whinchat, which here form important breeding populations (Limbert *et al.*, 1986; Roworth 1992). Older trees colonised by *Piptoporus betulinus*, *Fomes fomentarius* and other fungi are the home for beetles like *Strangalia quadrifasciata*, *Triplax russica*, and *Synchita humerale*, such flies as *Tanyptera atrata*, *T. nigricornis*, *Eustalomyia vittipes* and *Xylotomima nemorum*, and an extremely rare moth, *Bankesia douglasii* (Sutton & Beaumont, 1989). In the recent survey of Hatfield Moor, by far the most abundant fly under birch scrub on dry peat was the minute sciarid midge *Cratyna wasmanni*. This was also discovered during 1988 and 1990 in Norfolk, Suffolk and County Durham, and was recognised as a new British species by Laurence (1994). Originally described from specimens reared from nests of the ant *Lasius niger* in Holland (Schmitz, 1918), it was interesting to find that this ant also occurs abundantly in peat in the Hatfield Moor site. The fly has not been found on Thorne Moor.

A detailed appraisal of the recent records of the "Hairy Canary" strongly suggest that it is a denizen of the peripheral woods, and especially the *Salix*/*Alnus* carrs. The mass of data from pitfall and water trap work on Thorne and Hatfield Moor shows that the presence of *Sphagnum* is not essential for this fly as had been previously believed (Skidmore, 1985, 1991). In some sectors of Thorne Moor where peak populations of the fly occurred, and in many places on both moors where smaller numbers were taken, *Sphagnum* is certainly absent. Larger populations were found in carr woodland on warp than in birch woodland on peat, although the species is unquestionably restricted throughout its range to lowland raised mires, and is not a fenland insect. No specimens were collected from open peat moor lacking tree cover. Results also show that the flight period may last for less than two weeks in late June, but a staggered emergence from early June to early August occurs some years.

6. **Fens and Saline marsh.** Now almost eradicated from Hatfield Moor, the best fens today are around Bells Pond on Thorne Moor's western edge. This area is strongly saline and supports the richest salt-marsh insect fauna in Yorkshire. The salinity is certainly maintained by the brine emanating from the flooded seams of Thorne Colliery, but a littoral flora and fauna predated the sinking of the colliery shafts, or even the warping of the land during last century (Skidmore *et al.*, 1987). By the brackish lagoons of Bells Pond grow plants like *Salicornia* and *Aster tripolium*, whilst the insect fauna includes a remarkable array of salt-marsh flies including *Limonia complicata*, *Stratiomys singularior*, *Dolichopus diadema*, *Hydrophorus balticus*, *Campsicnemus magius*, *Melieria omissa*, *Playcephala planifrons*, *Zaphne divisa*, *Limnospila albifrons*, *Lispe pygmaea* and *Spilogona baltica* (Skidmore *et al.*, 1987; Heaver & Eversham, 1991). The extensive *Phragmites* beds support many nationally rare insects including the ground-beetle *Dromius longiceps*. The 1990 survey revealed an interesting incidence here of apparent hybridisation, according to male genitalic characters, between the Large Ear moth *Amphipoea lucens* and the Saltern Ear *A. fucosa* ssp. *paludis*. This presumably arises from the close juxtaposition of peat-bog and salt-marsh, the respective habitats of these two very closely related moths, whose occurrence in Yorkshire is little known (Sutton & Beaumont, 1989).

HATFIELD MOOR

Unfortunately, Hatfield Moor never received the degree of attention from naturalists which had been accorded to Thorne Moor, despite its evident and long-recognised richness (Limbert, 1985, 1986a). The 1991-92 survey carried out there by Doncaster Museum staff was intended to partially rectify this and the results are being prepared for publication (Skidmore & Eversham *in prep.*). Ball (1992) showed that Thorne Moor was the richest lowland peatland site in the United Kingdom in terms of its invertebrate fauna. The Hatfield Moor Survey results show a comparable richness. Four habitats occur at Hatfield Moor which today are unrepresented on Thorne Moor, namely dry grassland, dry heath, old oak woodland and stands of Scots pine.

Dry grassland and heath. It had long been recognised that Hatfield Moor differed in many respects from Thorne Moor, not least in the generally drier conditions. The recent survey emphasised this when it was found that the most abundant ground-beetle was *Pterostichus versicolor*, a much scarcer species on Thorne Moor. The central Lindholme moraine with its sandpits was known as a sanctuary for such drier grassland moths as the Wood Tiger, Archers Dart, Antler, Small Elephant Hawk, Five-spot Burnet and Cinnabar moths etc. Surprising additions in the recent survey were the Six-belted Clearwing moth *Bembecia scopigera* and scarce beetles like the weevil *Gronops lunatus*, the ground-beetle *Amara fulva* and the shield bug *Legnotus picipes*. Here too the Pill Woodlouse *Armadillidium vulgare* occurs with its fly parasite *Phyto melanocephala*. Like *B. scopigera* these testify to a calcareous content in the drift deposits on the moraine.

Old oak woodland. As stated above, before peat-bogs developed on Hatfield Chase, a virgin forest of oak and pine existed here. Remarkably, rare elements of the lignicolous fauna of the oaks remain on Hatfield Moor. A typical old-woodland ground-beetle which is abundant here but unrecorded at Thorne is *Pterostichus oblongopunctatus*, whilst another carabid, *Laemostenus terricola*, still occurs on Lindholme moraine in its ancestral habitat of badger setts in old woodland. Lignicolous rarities surviving on the old Lindholme oaks include the beetles *Phloiotrya vaudoueri* and *Anitys rubens*, both of which occur at Thorne only as subfossils (Buckland, 1979). The nationally rare Scarce Vapourer moth *Orgyia recens* was also found in association with old oaks in two areas on Hatfield Moor during the 1991 Survey.

Scots Pines. The Hatfield Moors Scots Pines, which are evidently descendants of those still standing in De la Pryme's time (Skidmore, 1970), support a rich phytophagous insect fauna including the mirid bug *Pilophorus cinnamopterus*, but the lignicolous fauna presumably died out through a discontinuity in the presence of dead pine timber. Recent work on the "Bronze Age forest" exposed by surface-milling on Thorne Moor (Caufield, 1991) showed that the pine timber fauna at the time was extremely rich and indicative of drier, hotter summers (Buckland, *in press*).

Visitors to the Moors

Surveys on Thorne and Hatfield Moors have shown that whilst some faunal elements may remain over vast periods of time, there is a constant influx of visitors. Some, like the Merlin and Hobby, pass through regularly (Limbert *et al.* 1986), whilst others, including the Desert Locust fly *Stomorhina lunata* only occur during very unusual climatic conditions (Heaver & Eversham, 1991). Faunal and floral changes also occur as some organisms become extinct whilst others arrive to take up residence. Thus, Fallow deer which formerly occurred here (Limbert, 1990) have now been replaced by Roe deer (Limbert, 1991); but the only visitors capable of ensuring the continued survival of the moors are the human visitors. For over a hundred years the public had been denied access by the commercial peat-extractors. This was a source of constant conflict, since access had been a matter of Common Right to local people since Saxon times. Bunting fought tenaciously, against deeply entrenched commercial interests, to show that these rights had not been legally extinguished, either during the period of the Enclosures, or subsequently. Unable to complete his work, his documents were deposited in the Archives at York and Nottingham Universities in the hope that others could take up the fight. The public access issue was of pivotal importance in the Wildlife Conservation battle for these moors, and it is vital that these rights be upheld in the future. People should be encouraged to come, and, moved by the sheer wonder of creation to be seen here, to ensure their retention for posterity. As King George VI said, "The Countryside and Wildlife of today are not ours to do with as we please, we must account for them to those who come after".

Acknowledgments

Limited space precludes a complete list of all of those people who made my years in Yorkshire so enjoyable. It was Dr E. F. Gilmour who appointed me to Doncaster where it all began. It was through my work there that I met my wife Heather, whose patient

endurance and support have meant everything to me. The move to Doncaster also brought me into the naturalist fraternity in Yorkshire, through my museum colleagues and membership of the Doncaster Naturalists' Society and Yorkshire Naturalists' Union. In the entomological section of the latter body it was a great honour and joy to be associated with the finest entomological association outside London. To all of you whom I have met, and with whom I have conversed in these arenas, I would like to express my warmest thanks and appreciation. I would also like to express my thanks to all with whom I have worked in Wildlife conservation in Yorkshire, and especially to those rare individuals, including Lord Feversham of Duncombe Park and the Lyon family of Lindholme, who were such exemplary and caring custodians of the wonderful Wildlife refugia in lands belonging to them. I wish to thank the Yorkshire Naturalists' Union for honouring me with the Presidency for 1995, and the Doncaster Naturalists' Society and Sorby Naturalists' Society for bestowing upon me Life Membership. For the illustrative material for this address, thanks are offered to the Thorne and Hatfield Moors Conservation Forum for the loan of their excellent slide-pack, and to Mark Lomas (Doncaster Museum), Peter Roworth (English Nature) and John Bebbington (Field Studies Council) for slides of additional species. Finally, deep gratitude is acknowledged to the late William Bunting for his friendship and inspiration, and to Paul Buckland who opened up for me the fascinating new dimension of Palaeoentomology.

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ENTOMOLOGICAL REPORTS FOR 1992-1995, COLEOPTERA: STAPHYLINIDAE (ALEOCHARINAE)

M. L. DENTON

This is the first report to document the Aleocharinae of Yorkshire since that which ppeared in *The Naturalist*, **117**: 71-75. Although the collecting and identification of pecimens continues, albeit by a small but dedicated few, it is becoming increasingly ifficult to locate species which generate publishable records (generally to be taken as pecies new for the county or respective vice-county). This is not an indication that the Aleocharinae of Yorkshire have been so well studied that the final word has been published or, indeed, that the county has been neglected. It is simply a reflection of the dedication of nthusiasts who have tended to favour certain localities and, although this may add to our nowledge of the site, it does mean that other areas in the county remain neglected. In this espect, survey work carried out for English Nature along the Lower Derwent Valley has evealed the true singificance of the area. Additionally, work on a number of Yorkshire Wildlife Trust reserves has also indicated the importance of these sites. I feel sure that many more Yorkshire Aleocharinae remain to be documented, and the true distribution of many of the commoner species will remain obscure for many years to come.

As Yorkshire's Aleocharinae enthusiasts become more proficient at identification the need for the backing of a knowledgeable specialist becomes less necessary. It will be noted, however, that for the more problematical groups and confirmation of several specimens, Mr C. Johnson of the Manchester University Museum has once again been instrumental in affording his expertise, and in this respect he must be thanked wholeheartedly.

Past Aleocharinae reports have placed no emphasis on the species' national status and, to rectify this, all species quoted in the Joint Nature Conservation Committee publication *A Review of the Scarce and Threatened Coleoptera of Great Britain, Part 2*, have been categorized as follows:

1) NOTABLE i.e. estimated to occur within the range of 16 to 100 squares of the National Grid.
2) INDETERMINATE i.e. considered to be Endangered, Vulnerable or Rare, but lacking sufficient information to determine which of these categories is appropriate.
3) INSUFFICIENTLY KNOWN i.e. taxa with very few known localities, but which belong to a poorly recorded or taxonomically difficult group.

For reasons described in the first Aleocharinae report (*Naturalist* **111**: 91-96), the sex of the specimen(s) on which identification was based has been indicated; it can be assumed that all specimens were male, unless otherwise stated.

I would like to take this opportunity to thank the small number of dedicated collectors and identifiers for their continued support in documenting the Aleocharinae of Yorkshire. The following initials appear in the list that follows: RBA = R. B. Angus; EWA = E. W. Aubrook; LA = L. Aukland; RGB = R. G. Booth; MLD = M. L. Denton; WAE = W. A. Ely; RJH = R. J. Hunt; CJ = C. Johnson; PK = P. Kendall; RSK = R. S. Key; RJM = R. J. Marsh; DM = D. Maude; JM = J. Muona; JAO = J. A. Owen; KGP = K. G. Payne; ADAS = Aricultural Development & Advisory Service; PS = P. Skidmore and EJS = E. J. Smith.

Myllaena intermedia Erichson. (63) Conisbrough (SK59), female, 5/5/92, in reed bed debris; RJM. The only previous records are from Burniston (TA09) in 1930 & 1931, Skipwith Common (SE63) in 1971, Sprotbrough Reservoir (SE50) in 1971 & 1972, Studley (SE26) in 1989 and Wheldrake Ings (SE74) in 1989.

Gyrophaena angustata (Stephens). (*65) Cover Banks (SE18), 6/6/92, in *Polyporus squamosus*; MLD. A widespread but very local species that is recorded from England and North Wales and is afforded Notable status.

G. bihamata Thomson. (64) Ringhay Wood (SE43), 20/7/93, in *Polyporus squamosus*; RJH det. MLD. The only previous records are from Skipwith (SE63) in 1915, Torne Bridge (SE6O) in 1969, Thorne Moor (SE71) in 1985, Rudston (TA16) in 1989 and Owston Wood (SE51) in 1990.

G. joyioides Wusthoff. (64) Ringhay Wood (SE43), 20/7/93, in *Polyporus squamosus*; RJH det. MLD. The only previous record was from Hetchell Wood (SE34) in 1989. Mainly restricted to southern England, the above mentioned records being the furthest north. A species afforded Notable status.

G. nana (Paykull). (*65) Cover Banks (SE18), 6/6/92, in *Polyporus squamosus*; RJM. The only previous records are from Skipwith Common (SE63) in 1916, Allerthorpe Common (SE74) in 1923, Bolton Percy (SE54) in 1943 and Torne Bridge (SE60) in 1969.

Bolitochara mulsanti Sharp. (*65) Cover Banks (SE18), 6/6/92, in *Polyporus squamosus*; RJM. A widespread but locally distributed species that is mainly confined to northern England and Scotland and is afforded Notable status.

Tachyusa leucopus (Marsham). (64) East Keswick Fits (SE34), not sexed, 29/5/86, amongst shingle; RSK (teste MLD). This record pre-dates that published in *The Naturalist*, **117**: 72 to become the first for VC64.

Gnypeta velata (Erichson). (61) Wheldrake Ings (SE74), 29/7/92 and 22/8/92, in vegetable refuse along the Old Course of the River Derwent; MLD det. CJ. Restricted to the southern half of England and mid-Wales, these records being the furthest north. A species afforded Notable status.

Callicerus rigidicornis (Erichson). (63) Loxley Common (SK39), not sexed, 19/5/93 and 29/6/93; EJS det. MLD. Burgy Banks (SE60), 26/8/93, pit fall trap, English Nature det. MLD. Broadhead Clough (SD92), 14/5/94; MLD. The only previous records are from Bramley (SK49) in 1986, Gillfield Wood (SE09) in 1989, Newton Ings (SE42) in 1989 and Owston Wood (SE51) in 1990.

Dacrila fallax (Kraatz). (61) Broomflect (SE92), female, 24/2/93, in tide line refuse; RJM. The only previous records are from Spurn (TA41) in 1948, Fisherman's Channel (TA21) in 1991 and Haverfield Quarry (TA32) in 1991. A very local species that is widely scattered over southern England, the above mentioned records being the furthest north. The species is afforded Notable status.

Amischa soror (Kraatz). (*64) Askham Bog (SE54), female, 2/9/94; RGB.

Dochmonota clancula (Erichson). (64) Askham Bog (SE54), not sexed, 2/9/94; RGB. The only previous records are from Askham Bog (SE54) in 1969 & 1972, Guisbrough (SK59) in 1986, North Duffield Carrs (SE63) in 1987 and North Duffield Ings (SE73) in 1990. A widespread but locally distributed species that is confined to England. The species is afforded Notable status.

Atheta terminalis (Gravenhorst). (64) Wheldrake Ings (SE74), 11/3/95, in flood refuse; MLD. The only previous records are from Bubwith in 1919 and 1933. A very local southern species with seattered records north to Yorkshire. It has recently only been recorded from two viee-counties (South Hampshire and Worcestershire). The species' national status is given as Insufficiently Known.

A. vilis (Erichson). (*64) Askham Bog (SE54), not sexed, 2/9/94; RGB. The only previous record was from Sprotbrough (SE50) in 1987.

A. monticola (Thomson). (63) Dean Head Wood (SE10), 11/7/92, in decaying fungi; MLD. The only previous records are from Cornelian Bay (TA09) in 1928, Blackmoorfoot (SE01) in 1983, Netherton (SE11) in 1983, Austwick Moss (SD97) in 1983 and Lepton Great Wood (SE11) in 1985.

A. liturata (Stephens). (*65) Cover Banks (SE18), both sexes, 6/6/92, in *Polyporus squamosus*; MLD.

A. fungicola (Thomson). (62) Clifton Ings (SE55), female, 10/8/52, in decaying fungi; MLD (teste CJ). The only previous records are from Mulgrave Wood (NZ81) in 1934, Goathland (NZ80) in 1935, Blaekmoorfoot (SE01) in 1989 & 1990 and Studley Park (SE26) in 1990.

A. amplicollis (Mulsant & Rey). Elland gravel pit (SE12), both sexes, 19/2/83; MLD. Blackbum Valley (SE02), female, 23/4/83; MLD. Dean Wood (SE11), female, 11/12/83; MLD. Netherton (SE11), female, 11/2/84; MLD. Hall Dike (SE11), female, 15/2/84; MLD. Warwick (SE11), female, 27/4/84; MLD. Hades (SE10), female, 3/2/85; MLD. These records pre-date those published in *The Naturalist*, **113**: 149 and **115**: 100 to become the first for VC63.

A. gilvicollis Scheerpeltz. (62) Wydale Hall (SE98), 9/4/94; LA det. MLD. The only previous records are from Thorne Moor (SE71) in 1969 and Runswick Bay (NZ81) in 1990.

A. orphana (Eriehson). (61) Wheldrake Ings (SE74), 2/2/85; RGB det. JM. A species afforded Notable status that is confined to the southern half of England, this record being the furthest north.

A. dadopora Thomson. (*62) Gundale (SE88), female, 19/6/94; MLD.

A. incognita (Sharp). (63) Rivelin (SK28), female, 26/1/93; EJS (teste MLD). (62) Ellers Springs (SE88), female, 3/9/95; LA (teste MLD).

A. nidicola (Johansen). (*63) Blaekbrook Wood (SK28), female, 5/1/92; EJS (teste CJ). The only previous records are from Dalby Forest (SE88) in 1966 and Askham Bog (SE54) in 1967.

A. ravilla (Eriehson). (*65) Cover Banks (SE18), 6/6/92, in *Polyporus squamosus*; MLD.

A. nigripes (Thomson). (*64) Bolton Abbey (SE05), 23/5/92, under bark; MLD.

Ilyobates subopacus Palm. (61) Wheldrake Ings (SE74), sex ?, 15/5/79; CJ. North Duffield

Ings (SE73), 13/5/86, in a *Glyceria* bed; PK det. MLD and 11/8/93, female, in flood refuse; MLD. The only previous records are from North Duffield Ings (SE73) in 1985 and Shirley Pool (SE51) in 1986. A widespread but locally distributed species that is afforded Notable status. The first mentioned record pre-dates those published in *The Naturalist* **113**: 150 to become the first for Yorkshire.

Calodera protensa Mannerheim. (64) Cawood (SE53), 5/92, pit fall trap in wet meadow; KGP det. MLD. The only previous record is from the same locality in 1990. Formerly recorded from North Essex and Oxfordshire, the above mentioned records are the first since the 1920s. The species is afforded Indeterminate status.

Chiloporata rubicunda (Erichson). (*65) Raydale Beck, Semerwater (SD98), not sexed, 3/9/85; RSK det. MLD. The only previous records are from Scarborough (TA08) on an unrecorded date and Duncombe Park (SE68) in 1983. A widespread but locally distributed species that is afforded Notable status.

Ischnoglossa prolixa (Gravenhorst). The realisation that two species were masquerading under this name (*Entomologist's Record*, **106**: 241-244) has made all records on the YNU database suspect. Examination of extant specimens has revealed the following authentic records: (61) Thornton Ellers (SE74), 28/3/89; MLD. (63) Old Spring Wood (SE11), 20/4/84; DM det. MLD. Elland Park Wood (SE12), 22/9/85; MLD. Dean Wood (SE11), 11/1/86; MLD. Orange Wood (SE11), 21/9/87; MLD. Mag Brook (SE11), 23/10/88; DM det. MLD. Langsett (SE20), female, 8/4/90; EJS det. MLD. Willowgarth (SE52), both sexes, 14/4/90; MLD. High Burton (SE11), 29/4/90; MLD.

Crataraea suturalis (Mannerheim). (64) Bolton Abbey (SE05), 23/5/92, under bark; MLD. The only previous records are from Beckhole (NZ80) on an unrecorded date, Elland gravel pit (SE12) in 1946, Swinden Plantation (SE10) in 1988 and Studley Royal (SE26) in 1989.

Oxypoda alternans (Gravenhorst). (*65) Cover Banks (SE18), both sexes, 6/6/92, in *Polyporus squamosus*; MLD.

O. brachyptera (Stephens). (61) Bubwith Ings (SE73), female, 8/9/93, in old straw; MLD (teste CJ). Aughton Ings (SE63), late summer 94, in a pit fall trap set along a drain; ADAS det. MLD. North Duffield Carrs (SE63), late summer 94, in a pit fall trap set along a drain; ADAS det. MLD. The only previous records are from Aughton Ings (SE63) in 1987 & 1988, Bubwith Ings (SE73) in 1988 and Semerwater (SD98) in 1988.

Aleochara albovillosa Bernhauer. (*62) Hole of Horcum (SE89), 12/10/94; LA det. MLD.

A. bipustulata (Linnaeus). The realisation that more than one species was masquerading under this name (*Entomologist's Record*, **102**: 227-232) has made all records on the YNU database suspect. Examination of extant specimens has revealed the following authentic records: (61) Fisherman's Channel, Sunk Island (TA21), 17/8/85; MLD det. JAO. (63) Cold Edge Dams (SE02), 28/8/83; MLD det. JAO. Salterhebble Lock (SE02), 30/5/84; MLD det. JAO. West Wood, Farnley Tyas (SE11), 20/6/84; DM det. JAO. Pot Riddings Wood (SE50), 13/6/87; MLD det. JAO. (64) Fairburn (SE42), 24/8/86; MLD det. JAO.

A. discipennis Mulsant & Rey. (63) Roche Abbey (SK58), 18/5/86, WAE det. CJ. A very local species that is confined to England and is afforded Notable status.

A. diversa Sahlberg. (63) Willowgarth (SE52), 10/5/92, in dead Coot *Fulica atra*; RJH det. MLD (teste CJ) and 23/4/93, in dead Hedgehog *Erinaceus europaeus*: RJH det. MLD. A very local species that is afforded Notable status. As past records of this species may have referred to *A. albovillosa* Bernhauer these are the first authentic Yorkshire records.

A. fumata Gravenhorst. (63) Hatfield Moor (SE70), female, 30/7/91, pit fall trap in scrub/heath on peat; PS det. MLD. The only previous record was from Newmillerdam (SE31) in 1966. A very local species with a widely scattered distribution, although until recently it has only been recorded from three vice-counties (West Sussex, Surrey and Leicestershire & Rutland). The species' national status is given as Insufficiently Known.

THE ACULEATE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF SHIPLEY GLEN IN WATSONIAN YORKSHIRE WITH A "THEN" AND "NOW" COMPARISON

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Shipley Glen has been found to be a very good locality for aculeate wasps and bees, having 89 recorded species, three species of national importance, and 13 species of regional importance. It is an area of about 66 hectares, situated to the north west of Shipley, West Yorkshire (VC64, SE13). The locality, a partly wooded valley on millstone grit with open habitats of acid grassland, heather moorland, has a large disused quarry at the northern end.

Shipley Glen was surveyed extensively from the end of the 19th century until about the middle of the 20th century. The main collector was J. Wood whose specimens, which were largely undetermined, were found at Keighley and Manchester Museums (Wood sample). I am grateful to the curators of these museums, M. Hartley and C. Johnson, for permitting access to Wood's specimens. John ("Jack") Wood was well known to Keighley collectors for a long period of time both as a collector and recorder of many forms of insect life (Ogden 1968). He corresponded with W. D. Hincks of Manchester University Museum.

Between 1919 and 1949 I have been able to establish that Wood made 83 visits to Shipley Glen, distributed throughout the year as follows: March (2 visits), April (3), May (19), June (22), July (19), August (7), September (11).

Between 1979 and 1994, I made 16 visits centred on the northern part of the disused quarry. The visits were distributed throughout the year as follows: April (1 visit), May (3), June (3), July (5), August (3), September (1). Two of the visits during July were unsuitable for surveying aculeate wasps and bees because of poor weather conditions. During these approximately three hour visits all species of aculeate wasps and bees were recorded (Archer sample) and usually collected with a hand net for identification.

A comparison will be made between the Archer and Wood samples although the activities of these two recorders were not exactly the same, Archer being a specialist recorder of aculeate wasps and bees, while Wood was a generalist collecting many groups of free-living insects.

A few records were also found from R. Butterfield (collecting from 1907 until 1925); F. Rhodes (collecting from 1915 until 1920); one record each from J. W. Carter (before 1900) and J. A. Beck (before 1950); and three records (two from 1890, one from 1918) from unknown collectors. From more recent times the records of J. T. Burn were made available from a visit on 12 June 1988.

In the following account, biological names are according to Kloet and Hincks (1978).

Species Present

A full list of species with their collectors is given in the Appendix. The taxonomic distribution is given in Table 1, at the family level. The dominant solitary wasp family is the Sphecidae and the dominant solitary bee family the Andrenidae, closely followed by the Halictidae and Anthophoridae.

Archer-Wood Comparison

Archer and Wood recorded the same number of species of solitary wasps (Table 1), although only seven species (26%) were common to both samples. Archer recorded more solitary bee species than Wood and 26 species (68%) were common to both samples.

Ten species (5 solitary wasps, 5 solitary bees) were recorded by neither Archer nor Wood.

Thirty-three solitary species were recorded by both Archer and Wood, 19 species only by Archer and 13 species only by Wood. These data can be compared by calculating similarity indices. Using the simple Jaccard index (Ludwig & Reynolds, 1988), which

depends upon the presence or absence of species, gives an index of 50.8%. The Morisita-Horn index, which uses quantitative information on the relative abundance of species, is relatively independent of sample size but gives more importance to the more abundantly occurring species (Magurran, 1988). Abundance was determined from the number of days on which a species was observed. The Morisita-Horn index is 73.1% which is higher than the Jaccard index. This indicates that the Archer and Wood samples are more similar to one another in terms of the more abundant species. Of the 32 species found by only either Archer or Wood, only five species (16%) were more abundant species recorded on more than three days each. Twenty-seven species (84%) were less abundant, and recorded on one, two, or three days each.

TABLE 1
The number of species of aculeate wasps and bees recorded from Shipley Glen in the Archer and Wood samples and from all records.

	All	Archer	Wood
Solitary wasp			
Chrysididae	2	1	1
Mutillidae	1	0	1
Sapygidae	1	0	0
Pompilidae	5	2	2
Eumenidae	3	0	1
Sphecidae	20	14	12
Total solitary wasps	32	17	17
Solitary bees			
Colletidae	1	1	0
Andrenidae	17	12	13
Halictidae	13	10	8
Megachilidae	1	1	0
Anthophoridae	11	11	8
Total solitary bees	43	35	29
Total solitary wasps and bees	75	52	46
Social wasps and bees			
Vespidae	4	4	–
Apidae	10	10	–
Total social wasps and bees	14	14	–
Total aculeate wasps and bees	89	66	–

The five more abundant species were *Andrena barbilabris* recorded only by Wood and *Colletes succinctus, Andrena nigroaenea, Nomada goodeniana* and *N. rufipes* recorded only by Archer. The cleptoparasite of *C. succinctus, Epeolus cruciger*, was found by Wood which suggests that *C. succinctus* was present but not found by him. Wood also found the probable host of *N. rufipes, Andrena fuscipes*, which suggests *N. rufipes* could have been present.

N. goodeniana with its cleptoparasite *A. nigroaenea*, and *A. barbilabris* are common solitary bees in Watsonian Yorkshire so unlikely to be missed if present at Shipley Glen. To account for the presence or absence of these species it is suggested that these species migrate to Shipley Glen from time to time, reproduce successfully for a period, and then become extinct.

The 27 less abundant species would probably have been present during the observation periods of Archer and Wood but were not found because the probability of finding each species was so small. Even within the Archer and Wood samples many species were only found on one, two or three days: 27 species (52%) of the Archer sample and 27 species

(59%) of the Wood sample. The species not found by Archer or Wood were either found on one (eight species) or two days (two species), again indicating the small chances of finding many species.

Seasonal Progression of the Solitary Species

From both the Archer and Wood samples the solitary wasp species were recorded only during the summer months (Table 2). July was the most productive month for the number of species and new species. The species most evident were the subterranean nesters *Crossocerus ovalis*, *C. pusillus* and C. *quadrimaculatus* which are all small fly hunters.

TABLE 2
The number of species and new species of solitary wasps and bees recorded per month at Shipley Glen from the Archer and Wood samples.

		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
No. species								
Solitary wasps	– Archer	0	0	0	3	14	4	1
	– Wood	0	0	0	5	10	2	4
Solitary bees	– Archer	0	8	25	21	16	13	6
	– Wood	1	4	22	17	10	6	4
No. new species								
Solitary wasps	– Archer	0	0	0	3	12	2	0
	– Wood	0	0	0	5	9	1	2
Solitary bees	– Archer	0	8	18	4	5	0	0
	– Wood	1	3	18	3	1	2	0

From both the Archer and Wood samples the solitary bee species were recorded during the spring and summer (Table 2). May, June and July were the most productive months for the number of species, with May the most productive month for new species.

The solitary bee species can be divided into three groups. Group one consists of the spring bees which emerge during March or April with the adult stage completed either during May or June, e.g. *Andrena haemorrhoa*, *A. fulva*, *A. lapponica*, *A. nigroaenia* and *A. scotica*, or by July, e.g. *A. barbilabris* and *A. cineraria*. *A. lapponica* is associated with the flowers of *Vaccinium* as a food source. Group two are the summer bees emerging during July with the adult stage completed during August or September, e.g. *A. fuscipes* and *Colletes succinctus*. *A. fuscipes* and *C. succinctus* are associated with the flowers of *Calluna*. Group three are bees present during both the spring and summer probably either undergoing two bisexual generations, e.g. *A. saundersella*, or with a spring fertilized female emergence and a summer bisexual emergence, e.g. *Halictus rubicundus*, *Lasioglossum rufitarse*, *L. fratellum* and *L. calceatum*. Group three bees emerge during April and May and persist until September.

The cleptoparasites of the above bees are given in Table 3. The cleptoparasite of *L. rufitarse* is unknown but in the context of Shipley Glen *Sphecodes fasciatus* could be the cleptoparasite.

Quality Assessment of the Solitary Species

Nomada lathburiana is a nationally rare or "Red Data Book" species (RDB3) (Falk, 1991) and is probably near the northern edge of its range. Two species, *Priocnemis schioedtei* and *Crossocerus walkeri*, are nationally scarce species (Falk, 1991) but are widely distributed in Great Britain. Regionally (Archer, 1993) *N. lathburiana* is a frequent species, *Priocnemis schioedtei* a common species, and *Crossocerus walkeri* a rare species. *C. styrius* also is a rare species in a regional context.

TABLE 3
Hosts and probable cleptoparasites of some solitary wasp and bee species from Shipley Glen.

Host	Cleptoparasite
Colletes succinctus	*Epeolus cruciger*
Andrena cineraria	*Nomada lathburiana*
Andrena fulva, A. fucata, A. lapponica	*Nomada panzeri*
Andrena fuscipes	*Nomada rufipes*
Andrena haemorrhoa	*Nomada ruficornis*
Andrena nigroaenia	*Nomada goodeniana*
Andrena saundersella	*Nomada flavoguttata*
Andrena scotica	*Nomada marshamella*
Andrena wilkella	*Nomada striata*
Andrena barbilabris	*Sphecodes pellucidus*
Halictus rubicundus	*Sphecodes monilicornis*
Lasioglossum calceatum	*Sphecodes monilicornis*
Lasioglossum fratellum	*Sphecodes hyalinatus*
Lasioglossum rufitarse	*Sphecodes fasciatus*

Eleven species have a local distribution in a regional context (Archer, 1994) being more-or-less restricted to sandy habitats. These local species are indicated in the Appendix.

By giving each of the 75 species of solitary wasp and bee a regional status (Archer, 1993) a regional quality score of 183 and a species regional quality score of 2.4 (183/75) can be calculated (Table 4).

TABLE 4
The regional status scheme of the 75 species of solitary wasps and bees recorded at Shipley Glen.

Status	Status value (A)	No. species (B)	Status score (A*B)
Common	1	47	47
Frequent	2	16	32
Occasional	4	8	32
Rare	8	1	8
Nationally scarce	16	2	32
Nationally rare	32	1	32

TABLE 5
The Archer national status scheme of the 75 species of solitary wasps and bees recorded at Shipley Glen.

Status	Status value (A)	No. species (B)	Status score (A*B)
Universal	1	45	45
Widespread	2	27	54
Restricted	4	0	0
Scarce B	8	2	16
Scarce A	16	0	0
Rare	32	1	32

Using a national status for each species (Archer, 1995), an Archer national quality score of 147 and an Archer national species quality score of 2.0 (147/75) can be calculated (Table 5).

Within the region of Watsonian Yorkshire the regional species quality score lies between that of Skipwith and Blaxton Commons. The Archer national species quality score is similar to that of Skipwith Common (Archer, 1995). Since Shipley Glen is about 44% the area of Blaxton Common and 21% the area of Skipwith Common its importance as a reserve for aculeate wasps and bees is demonstrated. The realisation of this importance is mainly due to the long period, in excess of 100 years, Shipley Glen has been surveyed for its aculeate wasps and bees.

CLEPTOPARASITIC LOAD

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. A more-or-less complete list of species in a locality should be made before the CL is calculated to avoid bias of either host or cleptoparasitic species. The CL for the species of solitary bees is higher than the CL for the species of solitary wasps (Table 6). These CLs are similar to values from other sandy habitats (Archer, 1992).

TABLE 6

The relative frequency of the cleptoparasitic species among the solitary wasps and bees from Shipley Glen.

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic load CL = 100*C/(H+C)
Solitary wasps	27	5	15.6
Solitary bees	28	15	34.9

AERIAL NESTER FREQUENCY

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Again a more-or-less complete list of species in a locality should be made before the AF is calculated to avoid possible bias of either aerial or subterranean nesters. The AF for the species of solitary wasps is higher than the AF for the species of solitary bees (Table 7).

TABLE 7

The nesting habits of the host solitary wasps and bees from Shipley Glen.

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = 100*A/(A+S)
Solitary wasps	15	12	44.4
Solitary bees	2	26	7.1

The wasp AF is similar to values from other sandy habitats but the bee AF is lower (Archer, 1992). The relative scarcity of dead wood in sheltered sunny situations could be the reason for the lack of aerial nesting solitary bees. Many of the aerial nesting solitary wasps could be nesting in stem cavities such as brambles so would be less affected by the lack of upstanding dead wood. It would be a useful management experiment to introduce upstanding dead wood into sheltered sunny situations to try and increase the species

diversity of solitary bees. The wood would need to be drilled with holes of different diameters and depths.

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Appendix

Aculeate wasp and bee species recorded from Shipley Glen. *Yorkshire local species. Collectors: A = Archer, Bc = Beck, B = Butterfield, Bu = Burn, C = Carter, R = Rhodes, W = Wood, U = Unknown.

Chrysididae: *Chrysis impressa* (A,W), *C. ruddii** (U).

Mutillidae: *Myrmosa atra* (B,W).

Sapygidae: *Sapyga quinquepunctata* (C).

Pompilidae: *Dipogon variegatus* (B), *Priocnemis schioedtei* (B,W), *Arachnospila anceps* (A), *A. spissa* (A), *Evagetes crassicornis* (W).

Eumenidae: *Ancistrocerus nigricornis* (B), *A. parietinus* (W), *A. scoticus* (B).

Vespidae: *Dolichovespula norwegica, D. sylvestris, Vespula rufa, Paravespula vulgaris.*

Sphecidae: *Trypoxylon attenuatum* (A), *Crossocerus elongatulus* (A,W), *C. ovalis* (A,Bu,W), *C. pusillus* (A,W), *C. tarsatus* (A), *C. annulipes* (W), *C. megacephalus* (A), *C. styrius* (W), *C. walkeri* (A), *C. quadrimaculatus* (A,W), *C. dimidatus* (A,W), *Ectemnius cavifrons* (A), *E. lapidarius* (W), *Lindenius albilabris* (A), *Rhopalum clavipes* (W), *R. coarctatum* (W), *Pemphredon lugubris* (A,W), *Passaloecus gracilis* (A), *Mellinus arvensis** (A), *Argogorytes mystaceus* (W).

Colletidae: *Colletes succinctus** (A).

Andrenidae: *Andrena clarkella** (A), *A. fucata* (A,W), *A. fulva* (A,B,R,W), *A. lapponica* (A,R,W), *A. scotica* (A,W), *A. bicolor* (W), *A. cineraria** (A,C,R,W), *A. nigroaenea* (A), *A. fuscipes* (A,W), *A. haemorrhoa* (A,B,Bu,R,W), *A. tarsata** (B), *A. barbilabris** (W), *A. chrysosceles* (A,W), *A. minutula* (U), *A. saundersella* (A,B,Bu,W), *A. subopaca* (W), *A. wilkella* (A,Bu,R,W).

Halictidae: *Halictus rubicundus* (A,R,W), *Lasioglossum albipes* (A,B), *L. calceatum* (A,R,W), *L. fratellum* (A,B,R,W), *L. rufitarse* (A,B,W), *L. cupromicans* (A.R.W), *L. leucopum* (B), *L. morio* (U), *Sphecodes fasciatus* (A,W), *S. gibbus* (A,B), *S. hyalinatus* (A,B,W), *S. monilicornis* (A,W), *S. pellucidus** (B).

Megachilidae: *Osmia rufa* (A).

Anthophoridae: *Nomada fabriciana* (A,B,R,W), *N. flavoguttata* (A,B,R,W), *N. goodeniana* (A), *N. lathburiana** (A,B,W), *N. marshamella* (A,B,R,W), *N. panzeri* (A,R,W), *N. rufucornis* (A,B,Be,R,W), *N. rufipes** (A), *N. striata* (A,R,W), *Epeolus cruciger** (A,W), *Anthophora furcata* (A).

Apidae: *Bombus lucorum, B. terrestris, B. lapidarius, B. jonellus, B. pratorum, B. hortorum, B. pascuorum, Psithyrus bohemicus, P. campestris, Apis mellifera.*

HEDGEROW DATING: A CRITIQUE

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There may have been no more popular topics for fieldwork in the environmental area in recent times than hedgerow dating. Botanists, ecologists, geographers and local historians have counted species in a multitude of hedgerows, and the results of many such surveys have frequently been published. One reason for the popular appeal of hedgerow dating is that it apparently produced important conclusions without any special expertise being demanded of the practitioner, other than the ability to recognise different shrub types.

If the notion of hedgerow dating first occurred to the great landscape historian, Hoskins (1967), it was refined and developed by Hooper (1970) of the Nature Conservancy Council and his associates, Pollard and Moore (1974). It was claimed that the age of a thirty-yard long section of hedge could be calculated by applying the following formula:

Age of hedge equals (99 x the number of shrub species) – 16

In practice, however, a simplified formula is commonly applied:

Age of hedge equals number of shrub species per 30 yards x 100

This produces "results" of a blissful simplicity, so that a three-species hedge would be 300 years old, a seven-species hedge, 700 years old, and so on.

It seems quite amazing that ecologists were so ready to embrace the theory, for the absence of any credible ecological mechanism to explain why new species should enter a fixed length of hedgerow at the strict rate of one per century was quite glaring. The hedgerow dating concept virtually invites us to imagine that in each thirty-yard section of hedgerow there dwells some sort of elfin gatekeeper, who will open the ecological doors to admit one new species each time a century has elapsed. No such gatekeeper exists: the concept of hedgerow dating is flawed, and it is vulnerable to attack on ecological, technical or logistical, and historical grounds.

ECOLOGICAL OBECTIONS

Given that the discipline of ecology places such high emphasis on the variations between environments and on the delicacy of the adjustment between plant species and their setting, it is surprising that hedgerow dating has enjoyed the uncritical support of so many workers in the environmental field since it seems to be essentially anti-ecological. For the hedgerow formula to work, each hedged field in the country should have the same number and types of potential colonists, and each colonist should enjoy an equality of opportunity to establish itself irrespective of where in the country it occurs. This is plainly not the case. If we compare, say, the chalk of Cambridgeshire with the grits and shales of Nidderdale we find that purging buckthorn (*Rhamnus catharticus*), wayfaring tree (*Viburnum lantana*), Midland hawthorn (*Crataegus oxyacanthoides*), spindle (*Euonymus europaeus*) and dogwood (*Cornus sanguinea*) are common on the southern calcareous soils but absent or very rare on the acidic northern soils. In short, the southern hedges have more potential colonists and so, other things being equal, they will be richer in different species than the northern hedges.

Such differences do not just occur between different ends of the country, but can be observed to operate within localities as one geological zone yields to another. For example, Hewlett (1980) has described how a Surrey hedge composed of hawthorn (*Crataegus monogyna*), oak (*Quercus robor*), sweet chestnut (*Castanea sativa*) and sycamore (*Acer pseudoplatanus*) changed into one made up of hawthorn, holly (*Ilex aquifolium*), privet (*Ligustrum vulgare*) and whitebeam (*Sorbus aria*) as it left the underlying clay with flints and ran on to chalk. Although Hooper in Pollard *et al.* (*1974*) suggested that local corrections to the formula might be worked out for each area, even if the dating concept were of value, the formula would then have to be recalibrated for availability of colonists, altitude, latitude, longitude, exposure, geology, aspect, predominant wind speed and direction and all those other variables which make each setting unique. Since the formula would then only describe the particular, there would be no general theory left.

There is another ecological objection – and one of particular severity. The hedgerow dating concept assumes that a hedgerow will gain new species at a predictable rate. In fact, hedgerows will often lose rather than gain species as they get older. This is a result of the well-known botanical process of invasion. Walk along any old, hedged track in Yorkshire, and it is likely that you will come across long sections of hedgerow composed entirely of elm (*Ulmus procera*); if you take your walk in the Dales, then similarly long stretches of holly will be encountered, while if the track crosses a damp and shady hollow then perhaps a stretch of bird cherry (*Prunus padus*) will appear. When particularly well adjusted to their settings, certain shrub species flourish to the point of becoming competitive and displacing their neighbours. Just as elm was invading some lowland woods before the outbreak of Dutch elm disease, so elm can be extremely competitive and invasive in a hedgerow, where it spreads by suckering. Other plants which demonstrate invasive capabilities are holly, which seems able, albeit slowly, to displace hawthorn by a process of self-layering, bird cherry and blackthorn (*Prunus spinosa*). As the invader gradually works its way along a section of hedgerow, then through time that section becomes species-poor, in total contravention of the hedgerow dating concept.

Technical difficulties

These are varied, and concern different aspects of the concept in operation. It seems to have been Williamson (1984) who first pointed out that the authors of published work on hedgerow dating vere wildly inconsistent in their choices of which plants qualified to be counted. Some count all *Rosa* sub-species: but if one does that then should not all the multitudinous *Rubus* sub-species be counted too? Hooper (1970) advised excluding from the species count what he termed "trailing plants", but other researchers include old man's beard (*Clematis vitalba*), honeysuckle (*Lonicera periclymenum*) and other trailing plants. Some count all *Prunus* species and sub-species separately, while others lump them together. Willmot (1980) split *Prunus* into all its sub-species yet clumped all *Rosa* sub-species together and then chose to count *Salix fragilis* separately while grouping all the other willows together, whereas Addington (1978) listed five willows separately.

Had hedgerow dating had any value, then one would wish to make comparative studies. However, this is impossible because the different researchers have devised their own rules for deciding which hedge species should be counted and which should be ignored. One realises the discrepancies which may result by considering a hypothetical hedgerow section which contains field rose (*Rosa arvensis*), dog rose (*Rosa canina*), bramble (*Rubus fruticosus*), dewberry (*Rubus caesius*), gean (*Prunus avium*), bullacc (*Prunus insititia*), old man's beard, and honeysuckle. One investigator could dismiss the bramblc, dewberry, old man's beard and honesuckle as trailing plants and group the *Prunus* and *Rosa* sub-species together, arriving at a species count of two and the conclusion that the hedgerow was but two centuries old. Another could consider all thc plants mentioned as being eligible for thc count, and thus award the hedgerow an age of 800 years.

Williamson (1987) rccognised that many Norfolk hedges which were still forming extensive networks when Tithe Award maps werc drawn in 1839 predated thc construction

of Roman roads in the area. Even if such hedges were only a century old when the Romans invaded, they should, according to the dating theory, have contained a good twenty species per thirty yard length. They could not, for there is only space in a thirty yard section of hedgerow for about a dozen mature shrubs. So even if hedgerow dating worked, it would be useless for dating hedgerows older than about the ninth century AD.

Another technical difficulty concerns the shortage of historically datable old hedges against which the results of hedgerow dating can be checked. Those relatively modern hedges, around 200,000 miles in total length, which originated in Parliamentary Enclosure can be dated virtually to the year when they were planted, for it was normally stipulated in the parochial enclosure award that the newly privatised land holdings should be enclosed within one year. However, for earlier hedgerows there is very little information available about dates of planting. Boundary hedges figure frequently in Anglo-Saxon land charters, and Rackham (1986) describes how hedges constitute between 1.8 and 3.4 per cent of features named in the descriptions of estate boundaries in different types of countryside. However, many Saxon estates and parishes descended from Roman estates, and a portion of these Roman holdings must in turn have descended from prehistoric land units; the hedges which bounded them could therefore have been ancient by the time that they were recorded by Saxon clerks.

All too frequently, hedgerow "daters" have assumed that because a hedge is *mentioned* in documents of a particular period it must also have been *planted* in that century: an assumption which far more often than not would be wrong. Medieval documents make quite frequent references to hedges, but since maps did not become available until the last stages of the medieval period and no system of locational co-ordinates existed, it is normally impossible to locate the hedges mentioned with sufficient precision and certainty. Very occasionally, medieval documents record the planting of a hedgerow in a possibly identifiable location. Thus, the bursar of Fountains Abbey reveals that in 1457/8 the sum of 11s. 8d. was spent on making 300 rods (about 1463m) of ". . . *sepes circa boscum Bradley per eundem*" of hedgerow around Bradley Wood, near Huddersfield. Even here there is uncertainty about precisely where the 15th century hedgerow actually ran, for the wood had shrunk before quarrying and open cast mining in this century further reduced its perimeter.

Historical Objections

The historical objections to the concept of hedgerow dating strike at its very core. The concept assumes that hedges are planted as monocultures and gradually gain species at a predictable rate. Yet if it can be shown that hedges were commonly planted with a mixed composition then the entire notion must crumble. In fact there is ample historical evidence that medieval hedges began their lives as mixtures of useful species. Pollard *et al*., (1974) recognised the likelihood that "very early planted" hedges would have been planted of mixed stock from nearby woods, but the real very early planted hedges belonged to the Neolithic and Bronze Age periods. Mixed hedges were being planted until the proliferation of nurseries, which was fuelled by garden mania and the needs of Parliamentary Enclosure, took place during the 18th century. (An early mention of commercial nurseries comes in John Evelyn (1664), where Evelyn tells of a gentleman who had improved his revenue by sowing hawthorn for sale ". . . by the hundred far and near". Elsewhere in his popular treatise, Evelyn advocated mixed hedges of hawthorn with oak, ash and elm planted at intervals.)

Johnson (1978) drew attention to the planting of mixed hedgerow and quoted Thomas Tusser (1573), who advocated the planting of mixed hedges composed of hawthorn and bramble:

> Where speedy quickset for fence ye will draw
> To sow in the seed of the bramble and haw

Elsewhere in his guide to good husbandry, Tusser mentions the purchasing of quicksets at market, a tantalising hint that hedging material had begun to be grown commercially by this time.


1/2 km
1/2 km
1/2 km
100m
200m
200m

Perhaps the most unequivocal statement of medieval hedging practices was provided by John Fitzherbert (1534) at the very close of the Middle Ages ". . . gette thy quicksettes in the woode countreye and let theym be of whyte thorn [hawthorn] and crabtree for they be beste, holye and hasell be good. And if thou dwelle in the playne countrey, then maste thou get both ashe, oke and elm, for those wyll encrease moche woode in shorte space."

Mixed hedgerows have been planted throughout the historical period, and probably for much longer still. In the 1st century BC, Columella advised mixing the seeds of thorns, briars, holly and eglantine with meal, applying the seed and meal mixture to an old wet rope and burying the rope in a trench. More than sixteen centuries later, in 1609, John Norden advocated the same hedge-planting technique and recommended a mixed planting of hawthorn, oak and ash (*Fraxinus excelsior*). The planting of mixed hedges even continued into the latter part of the Parliamentary Enclosure era in the west country. The landscape historian, Aston (1985), writes: ". . . enclosure in more recent times has been closely related to the activities of nurserymen supplying shrubs at the time of enclosure . . . In Somerset there were few nurserymen even in the nineteenth century, and so enclosure in Neroche Forest [which took place in 1830] seems to have involved digging up shrubs in the woods – hedges begin with eight to ten species!"

Management also exerts an influence on the species count. Put simply, in a badly-managed hedge, where laying is neglected and brutal trimming methods are employed, shrubs will gradually die and the species count will drop. Thus, hedgerow dating provides us with the anomalous situation of something that dies while supposedly becoming "younger"! Another management-related factor concerns elder (*Sambucus nigra*), which was removed from well-managed hedgerows because it is short-lived, with gaps appearing in the hedge when it dies. So the deduced age of a hedge could be affected according to whether or not the landowner had been diligent in grubbing-out elder.

Although hedgerow dating cannot provide us with accurate information about the age of hedges, other techniques can be borrowed from landscape history and applied to the problem. Firstly, it is possible to make a distinction between the older hedges, which curve and wind their ways across the fieldscape, and the younger hedges, whose arrow-straight courses and rectilinear networks were designed by the surveyors employed on Parliamentary Enclosure during the 18th and 19th centuries. In the east of England,

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FIGURE 1 (opposite)
Hedgerow Networks of Different Age

Upper left: Prehistoric fields, probably dating from the Iron Age, in Norfolk, as recognised by Williamson. The complete system of fields covered an area of at least 35km^2; the fields shared a common axis and were divided into rectangular blocks by lanes aligned, like the fields, slightly to the west of north.

Upper right: Surviving fragments of a Roman network of hedged fields in Essex.

Centre left: Typical ancient countryside on the edge of Dartmoor, with hollowed, winding lanes, dispersed settlement, numerous small woods (stippled) and small, irregular, densely hedged fields. The hedges probably predate the Middle Ages and are quite possibly prehistoric.

Centre right: Medieval assarts, Charnwood Forest, Leicestershire. The little hedged assarts represent the removal of woodland as colonisation advanced towards the area of rugged upland where the north point is positioned.

Bottom left: Piecemeal enclosure of medieval open field strips, Cumbria. These elongated fields, with their curving sides which trace reversed S or C forms, are characteristic of the gradual partitioning of open field land between members of the village community. The curving edges of each field were formerly the edges of plough strips which were grouped into parcels as "privatisation" eroded the open fields.

Bottom right: Parliamentary Enclosure, Yorkshire. The angular geometry has been transferred from the surveyor's map to the fieldscape.

particularly, the young hedges were generally planted using a hawthorn monoculture, but colonists like elder, *Rosa* agg., ash, bramble and sycamore have gained many a foothold (and these early colonists are generally more numerous than the hedgerow dating formula predicts). The older hedgerows may, as a result of invasion, contain many single-species stretches, but on the whole, they tend to be quite rich in species, though at any one time their composition must reflect a snapshot of the interplay between the originally planted mixture and the processes of inter-specific competition within the hedge.

Old maps displaying field names derived from medieval words for woodland, like "frith" or "hag", tell of woodland which existed before the land was cleared for farming. Field names like "royd" (which is particularly common in Yorkshire), "riddings", "sart", "stubbs", "stocks" and "stocking" denote woodland that was cleared or "assarted" in the creation of new fields. Most frequently, this took place in the two centuries before the arrival of the Black Death in 1348, when over-population and land hunger existed throughout the peasant communities. Hedged fields with one side, or two opposed sides, which trace the outlines of a reversed "S" or reversed "C" result from the piecemeal enclosure of medieval field strips, the strips curving in this way, because the ploughman would begin to swing the long plough team before the headland was reached (see Fig. 1). Such hedges are most likely to date from the later medieval centuries. The skills of the local historian take far longer to acquire than an ability to recognise and count hedgerow shrubs but historical methods will, with care, reveal many fascinating chapters in the long story of rural ecology.

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Y.N.U. BRYOLOGICAL SECTION: ANNUAL REPORT 1994-1995

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Sectional meetings during 1994-1995 have been held as follows:

Spring 1994 – Rivelin valley, Sheffield (VC63), 7 May
Autumn 1994 – Sutton Wood (VC61), 1 October
Spring 1995 – Levisham Moor (VC62), 13 May
Autumn 1995 – Whitfield Gill, Askrigg (VC65) 7 October

These are reported in the *Bulletin of the Yorkshire Naturalists Union.*

RECORDS

The list below includes all new vice-county records and other records of note. Recorders' initials: JMB = J. M. Blackburn, TLB = T. L. Blockeel; PCB = P. C. Bowes; DG = Donald Grant. An asterisk indicates a new vice-county record or an amendment to the *Census Catalogue*.

Marchantia polymorpha ssp. ***polymorpha***: (63*) 43/19. In stony flush on moorland bank, Upper Derwent valley, TLB, July 1994. This is confirmation in VC63 of the plant formerly known as *M. polymorpha* var. *aquatica*, which is now recognised as a good taxon.

Fossombronia wondraczekii: (64) 44/27. On exposed mud, Lumley Moor Reservoir, DG, 1994.

Jungermannia subelliptica: (62*) 44/89. On moist shaded rocks, Dundale Griff, Levisham Moor, TLB, May 1995.

Nardia geoscyphus: (62) 44/89. On wet silty soil of track, Esp Rigg, Cropton Forest, PCB 1994.

Marsupella emarginata: (63) 43/29. On grit boulder in wooded clough, Raynor Clough, More Hall Reservoir, TLB, Feb. 1994.

Porella platyphylla: (63) 43/57. On shaded south-facing Magnesian limestone, Southard's Plantation, Thorpe Salvin, TLB, Dec. 1995. Though common on the mountain limestone, *P. platyphylla* is very rare in southern Yorkshire.

Ditrichum flexicaule sens. str.: (62*) 44/88. On limestone rocks in disused quarry. Dalby Forest, JMB, Jan. 1994.

Dicranum montanum: (62*) 44/88. On tree bole in damp Alder woodland, 55m alt.. Ellers Wood, nr. Thornton Dale, Pickering, TLB & JMB. May 1994.

Tortula marginata: (63) 43/57. On shaded south-facing Magnesian limestone, Southard's Plantation, Thorpe Salvin, TLB, Dec 1995.

Leptobarbula berica: (63) 43/58. On Magnesian limestone slabs at ground level, ruins of Roche Abbey, TLB, Oct. 1995.

Oxystegus tenuirostris: (63) 43/29. On wet grit rock by stream in wooded clough, Raynor Clough, More Hall Reservoir, TLB. Feb. 1994.

Leptodontium flexifolium: (62) 44/89. On wet silty soil, Esp Rigg, Cropton Forest, PCB 1994.

***Pohlia drummondii*:** (62) 44/89. On wet silty ground, Esp Rigg, Cropton Forest, PCB 1994.

***Hookeria lucens*:** (63) 43/29. In wooded clough, Raynor Clough, More Hall Reservoir, TLB, Feb. 1994.

***Neckera crispa*:** (63) 43/57. On shaded south-facing Magnesian limestone, Southard's Plantation, Thorpe Salvin, TLB, Dec. 1995.

***Anomodon viticulosus*:** (63) 43/57. On shaded south-facing Magnesian limestone, Southard's Plantation, Thorpe Salvin, TLB, Dec. 1995.

***Heterocladium heteropterum*:** (63) 43/29. On grit boulders by stream in wooded clough, Raynor Clough, More Hall Reservoir, TLB, Feb. 1994.

***Isothecium myosuroides*:** (63) 43/2.9 On grit boulder in wooded clough, Raynor Clough, More Hall Reservoir, TLB, Feb. 1994.

***Isothecium striatulum*:** (63*) 43/57. On shaded south-facing Magnesian limestone, Southard's Plantation, Thorpe Salvin, TLB, Dec. 1995. This is another noteworthy addition to the flora of the Magnesian limestone tract in southern Yorkshire. Appropriately for a species of Mediterranean-Atlantic distribution, the locality is almost at the southernmost point of the county. *I. striatulum* is known from only two other stations in Yorkshire, at Gordale Scar and in Swilla Glen, Ingleton.

EXCURSION REPORTS

The recent reports of YNU General Meetings in the *Bulletin of the Yorkshire Naturalists' Union* **22** and *The Naturalist* **1013** contained some bryological omissions. The missing accounts are therefore reproduced here for convenience.

RUNSWICK BAY (VC62), 9th June 1990
The bryologists' route ran at the foot of the cliffs round Runswick Bay, and subsequently along the cliff top to Kettleness. It proved impossible to penetrate into the scrubby gullies from the foot of the cliffs, and only a few species were seen here, including *Barbula tophacea* on the clay. At Kettleness some time was spent on the acid shales, where the flora included *Campylopus introflexus, Barbilophozia atlantica* and *Cephaloziella divaricata*. The cliffs above had some slightly basic seepages with *Cratoneuron commutatum, Bryum pseudotriquetrum, Pohlia carnea*, and some more *Barbula tophacea. Gyroweisia tenuis* was also present. Particularly interesting was the presence of some ruderal mosses in natural habitats on the ledges, notably *Bryum gemmiferum, Leptobryum pyriforme*, and abundant *Funaria hygrometrica*. The return route took us around the head of the bay, and we were able to gain access into the top of one of the stream gullies. There were a number of woodland species here, including *Fissidens pusillus, Dicranum tauricum, Mnium stellare, Cirriphyllum piliferum, Ctenidium molluscum, Metzgeria furcata* and *Plagiochila britannica*.

MALHAM TARN (VC64), 5-6th June 1993. The published report (*Naturalist* **120**: 85-86) contains only half of that submitted, and should be supplemented with the following:

ɪREAT CLOSE MIRE

ɪreat Close Mire is well known for its distinctive hummock and runnel topography and alcareous mire flora. In and about the runnels, *Scorpidium scorpioides*, *Drepanocladus ossoni (=D. revolvens* var. *intermedius)* and *Cratoneuron commutatum* var. *falcatum* were videspread. The sides of the hummocks provide a specialised habitat for a number of rare ryophytes, notably *Amblyodon dealbatus* which was seen sparingly in three places. *'reissia quadrata*, *Leiocolea bantriensis* and *Gymnostomum aeruginosum* also occur in is habitat. Not many good hummocks were seen, however, and in places there were signs f damage caused by cattle trampling. About the main pool at the southern edge of the mire iere were some good patches of *Cinclidium stygium*, a rare mire species first added to the ritish flora from this area in 1836. There were several patches of *Breutelia chrysocoma*, nd a single tuft of *Scapania aequiloba* was seen here. This last is apparently a rare species ı Yorkshire and it has been mis-recorded in the past for *Scapania aspera*. Other mire becies included *Fissidens adianthoides*, *Philonotis calcarea*, *Campylium stellatum* and *lagiomnium elatum*. *Splachnum sphaericum* was seen on dung near the edge of the mire, nd *Pleuridium subulatum* was on soil in the adjacent pasture.

A separate flush to the south of Great Close Mire, near Mastiles Lane, had a small uantity of *Orthothecium rufescens*.

ᴀ MIRE

Iany of the calcareous mire species from Great Close Mire are also present at Ha Mire, ut some of the rarer species appear to be absent. It was interesting to see both *repanocladus revolvens* s. str. (*D. revolvens* var. *revolvens*) and *D. cossoni* at this site. hese two forms have been variously treated in the past but are now thought to be good becies. The differences were readily appreciated in the field, where only *D. revolvens* was ound with capsules. This is an autecious species and it fruits more freely than *D. cossoni*, hich is dioecious.

Parts of Ha Mire are more acidic and approach the conditions of raised bog. *Polytrichum ɪvestre*, *Mylia anomala* and *Odontoschisma sphagni* were seen on the peat.

NOTES ON THE EMPIDOIDEA (DIPTERA) OF A YORKSHIRE SALT-MARSH

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lt-marshes along the bank of the River Humber east of Hull are mainly small and are en poor in plant species (Crackles, 1990). To quote Dr Crackles (*op. cit.*) "By far and ay the best salt-marsh occurs to the south of Welwick. It is the most extensive, exhibits a ell marked zonation and is species-rich. Common Sea-lavender (*Limonium vulgare*) minates a large area and is an impressive sight in August, this being the only North umberside salt-marsh in which this species occurs in quantity".

Welwick salt-marsh (TA336189) forms part of the Humber Flats and Marshes Site of ecial Scientific Interest; it is roughly triangular in shape and is bounded on the north by elwick Bank and on the south-west by Patrington Channel.

During 1993 and 1994 I paid six visits to the salt-marsh on dates ranging from 30th May 6th September for the purpose of studying flies, especially those of the superfamily npidoidea (see Crossley, 1993 for details of this group).

Twenty-two species were recorded, of which most are widespread and common, curing in a range of habitats. However, the list contains a small suite of species which restricted to salt-marshes and these are dealt with in detail below.

Rhamphomyia (s.g. *Megacyttarus*) *maculipennis* Zett. The first record of this species in Yorkshire was in 1928 at Spurn (C. A. Cheetham). A single female was found on the saltings at Stone Creek (TA23.18.), undated but probably 1980, by P. Skidmore. At Welwick the species was present in small numbers on 30.5.94, both on the salt-marsh proper and also in the vicinity of hawthorn (*Crataegus monogyna*) at the sides of the lane leading to the saltings.

Rhamphomyia (s.g. *Pararhamphomyia*) *simplex* Zett. Found "in great abundance" on the saltings at Stone Creek, 7.6.80 (PS), it was similarly abundant at Welwick on 30.5.94, where, over the entire marsh, almost every sweep of the net produced many specimens of both sexes. Some were still present on 23.6.94 but none thereafter. The only other recorded Yorkshire locality is Blacktoft Sands R.S.P.B. reserve (SE82), 9.5.89 (RC).

Hilara lundbecki Frey. Reported from Spurn (*Naturalist* 1953, p. 161), this remained the only Yorkshire record until a single female was found at Welwick, 12.7.93.

Dolichopus sabinus Hal. Previously recorded at North Ferriby (SE92), west of Hull, 7.44, and at Spurn, 19.6.47, specimens were found at Welwick, 12.7.93 and 22.7.94.

Dolichopus (s.g. *Macrodolichopus*) *diadema* Hal. Recorded at Thorne Moors in the vicinity of a brackish drain in 1990; all other Yorkshire records are from sites along the Humber bank: Brough, 26.6.71 (RC), North Ferriby, 15.7.44 (probably CAC), Spurn, 19.6.47. (*Naturalist* 1953 p. 161). At Welwick specimens were found in 1993 and 1994 on dates between 23.6.-6.9.

Hydrophorus oceanus (Macq.). The first Yorkshire record for this most typical of salt-marsh flies was at Kilnsea (Spurn), 28.8.82 (RC). At Welwick the species was widespread and numerous, from the inner marsh to the farthest extremity bordering the Humber mud, on dates ranging from 30.5.-6.9.

Machaerium maritimae Hal. Spurn, where this species has been reported on several occasions from 1953, was the only recorded county locality until specimens were found at Welwick 12.7.93 and 22.7.94. On the latter date the species occurred on the outer marsh.

Campiscnemus armatus (Zett.). Spurn, North Ferriby, Blacktoft Sands and Moorends near Thorne Moors (probably in the vicinity of a brackish drain) are the previously reported Yorkshire sites for this species. At Welwick it was found on 12.7.93 and 17.8.93.

Other species recorded at Welwick which are often but not invariably associated with brackish conditions are: *Rhaphium consobrinum* Zett. and *Argyra vestita* (Wied.).

Empidoid species recorded at Welwick but not noted above are: *Platypalpus agilis* (Mg.), *P. kirtlingensis* Grootaert, *P. pallidiventris* (Mg.), *Hybos culiciformis* (Fab.), *Empis* (s.g. *Xanthempis*) *trigramma* Mg., *E.* (s.g. *Kritempis*) *livida* L., *E.* (s.g. *Empis* s.s.) *nuntia* Mg., *Dolichopus nubilus* Mg., *Dolochopus ungulatus* (L.), *Syntormon pallipes* (Fab.), *Campsicnemus loripes* (Hal.), *C. picticornis* (Zett.).

The taxonomic position of *Syntormon pallipes* is not clear; specimens were often abundant on many dates ranging from 30.5.-6.9. Of a sample of males taken on 17.8.93, 21 proved to belong to the var. *pseudospicatus* Strobl and 13 were *pallipes* (Fab.). The specimens have been retained, along with samples from this and other sites, for further study.

Acknowledgements

I am obliged to Denice Leach, Conservation Officer, North Humberside, English Nature, for helpful background information and advice regarding access arrangements.

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TREE-MALLOW (*LAVATERA ARBOREA* L.) IN S.E. YORKSHIRE

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BSTRACT

pulations of Tree-mallow (*Lavatera arborea* L.) have become established at three fferent locations on the north bank of the Humber estuary, S.E. Yorkshire, VC61. laphic, climatic and horticultural aspects of its occurrence are discussed.

TRODUCTION

Tree-mallow (*Lavatera arborea* L.) is native to the British Isles, with a natural stribution confined to rocks, cliff bottoms and waste ground near the sea on the south and est coast from Dorset to Ayrshire, the Channel Islands, and scattered in Ireland. It is garded as rare, being found in between 15 and 100 different 10 x 10km grid-squares in e British Isles (Stace, 1992). On the east coast of England the plant is considered to have en introduced, with an uncertain distribution due to confusion with the Garden Tree-allow (*L. olbia* "rosea"), (Malloch, 1994). The identity of the plants constituting these pulations has been confirmed as *L. arborea* (Dr N. K. B. Robson, *pers. comm.*).

This note describes *L. arborea* established in three new 10 x 10km grid-squares without ear indication as to its origin.

CORDED SITES AND HABITATS

e first population was found in 1991 near Cherry Cobb Sands (TA22). About a dozen nts were grouped together on bare, disturbed soil in the corner of a field and on the top the bank of a drainage ditch. Plants were subsequently noted at this site in 1993, 1994 d 1995 and on each occasion the population consisted of both flowering and first year nts. The population appears to have remained static due to the very small plot of land ilable.

Although the site is situated some 200 metres inland, it is close to a drainage ditch ntaining Sea Aster (*Aster tripolium*). The drainage ditches of this "Sunk Island" area are netimes inundated by a backwash of saline water for up to 2km from the Humber. The sence of Sea Aster and Sea Club rush (*Bolboschoenus maritimus*) in the drainage ditch work provides floral evidence of this.

Later in 1991, and again in 1995, several more stands of *L. arborea* were found along the dward side of the ridge of the Humber flood defence bank near Stone Creek (TA21) and r Cherry Cobb Sands. These were found in gaps in a dense, coarse flora consisting inly of *Heracleum sphondylum, Conium maculatum, Arctium minus, Dactylis glomerata* l *Arrhenatherum elatius*. However, this zone is within 10 metres of the littoral zone and hin 3 metres of the "supra-littoral zone", situated high on the riverside ridge of the bank. e bank is made up of limestone rocks faced on the landward side with soil drawn up n the base. The resulting channel seasonally contains brackish water. The bare rock face ries occasional supra-littoral species e.g. Sea Wormwood (*Seriphidium maritimum*), Sea et (*Beta vulgaris* ssp. *maritima*), Spear-leaved Orache (*Atriplex prostrata*) and Grass-ved Orache (*Atriplex littoralis*).

Later in 1995, a further population was found on a ditch bank between Paull Holme and Cherry Cobb Sands (TA12) but an assessment of population size and habitat was rendered difficult by inaccessibility and recent ditch bank mowing. This site is about 1km from the Humber on the bank of a ditch likely to be seasonally inundated with salt water.

Edaphic And Climatic Considerations

Lavatera arborea has two main habitats where it grows on cliffs. One is in bird colonies where it occurs in dense stands with *Beta vulgaris* ssp. *maritima, Atriplex prostrata* and *Tripleurospermum maritimum* (*Atriplici-Betetum* association; Géhu & Géhu, 1969). Another is in association with refuse from human habitation where this is deposited close to the sea. A high nutritional requirement therefore seems to be a factor in the success of the species in these habitats; salinity is also an important factor, but this may indicate a greater tolerance to a saline environment than its potential competitors rather than to salt being essential for optimal growth.

It has also been suggested (Malloch & Okusanya, 1979) that *L. arborea* may be restricted to sea cliff habitats because the maritime climate, characterised by a smaller temperature range and by having fewer frosts than inland areas, favours its survival. *L. arborea* seedlings are killed within three hours at –5°C and it is suggested that apart from direct destruction of seedlings and young plants by freezing, cold sensitivity in flowering plants results in a shortened growing season, causing failure of seed maturation (Okusanya, 1979). These climatic factors could be the main reasons why this southern maritime species has not become more widely established in northern Britain.

Horticultural Considerations

Lavatera aborea is a biennial plant sometimes cultivated as a garden plant. It is described as "not fully hardy in cold areas, but commonly found naturalised in coastal districts" and "winter protection with cloches is needed. . ." in cold districts (Hay, 1978). This species appears to be an unsuitable plant for garden cultivation in S.E. Yorkshire. The most popular garden *Lavatera* is the Garden Tree-mallow, known as *L. olbia* "rosea" or more recently *L. thuringiaca* "rosea". It is a perennial shrub and is hardier than *L. arborea.* Garden Tree-mallow, despite its local popularity, has not yet been recorded as a "garden escape" in this area.

Discussion

The habitat of each of these populations appears to fit the description "in bare places by the sea". However, none of the locations is associated with a bird colony or with composting human refuse. In two locations it is feasible that ditch dredgings rich in artificial fertilizer are a source of nutrients but the defence bank populations appear to be thriving with no known agency of nutritional enrichment. The coarse herb flora of this location does, however, indicate a soil with a high nutrient content.

As a biennial species, these populations appear to be successfully regenerating by producing seed and since at least one population has been in place since 1990, it can be concluded that the plant has become established. It is remarkable that none of these populations of such a conspicuous and attractive plant has been recorded before 1991. This suggests that they may have appeared for the first time in 1990.

It is difficult to rationalise why a biennial plant that is not grown locally and has relatively demanding habitat requirements should "escape" to, and establish in, locations so isolated from public access.

Conclusions

Tree-mallow (*L. arborea*), a species considered to be native only on the south and west coast of Britain, has clearly been introduced and has become established in S.E. Yorkshire. It appears to be surviving as a result of a succession of winters with temperature conditions conducive both to survival of individual plants and to seed maturation. The source of this introduction is difficult to deduce but it is considered unlikely to have escaped from local cultivation.

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With thanks to Dr N. K. B. Robson, The Natural History Museum, London, for termining *L. arborea* and to Dr A. J. C. Malloch, University of Lancaster, for providing urces of information.

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BOOK REVIEW

dgers by **Ernest Neal** and **Chris Cheeseman**. Pp. xiv + 271, with 51 line drawings and ures, 47 monochrome photographs and 23 colour plates. T. & A. D. Poyser. London. 96. £20.00.

dgers are among the best known and more attractive members of the British mammal na. This is in no small measure thanks to Ernest Neal's pioneering work and later dies. His New Naturalist monograph appeared almost fifty years ago; since then his earch on field biology, reproduction and conservation have continued to enhance our owledge of this fascinating species. A new dimension was added to badger study from 73 when the Ministry of Agriculture, Fisheries and Food identified the bovine TB terium in these animals. Since then Chris Cheeseman has been employed by the nistry as a field researcher. No publisher could have found two authors with a greater owledge of, and appropriate complementary interest in, badgers. What is more they are e to communicate their experience with a lively, readable enthusiasm.

This species has attracted much research over the past decade, partly generated through problems of badger-cattle TB interchange. The authors' coverage of new literature is only comprehensive and up-to-date, but is well placed in the context of what was viously known. The book's thirteen chapters include accounts of domiciles, ironmental requirements, activity, feeding, social life and relations with man. rything is here, Whether one wants to know about such diverse topics as habitat erence in Cumbria, bird predation or implantation.

is particularly pleasing to have a chapter on badgers and bovine TB. The current ation of this remarkably emotive subject is explained impartially. The nature of the ase, the history of the action taken and its relative success, possible mechanisms of erial exchange, geographical incidence of infections and prospective treatments are all ered. What emerges is the absence of a quick or ready solution. The production of a able vaccine is estimated to be two decades away and even then it is doubtful whether tself it would be effective. Compromises on badger management will have to be oted for the foreseeable future.

chapter on practical field study tells us how much of the information appearing in

earlier chapters was obtained and offers impetus and encouragement to the non-professional to engage in badger study. Perhaps surprisingly, techniques are often quite simple, with much to be learnt about behaviour and territoriality using nothing more complex than binoculars, image intensifiers and plastic bait markers.

The book has a diverse range of first-class illustrations. Delightful sketches by John Davies precede each chapter, further drawings are provided by Michael Clark and numerous colour and monochrome photographs are found throughout the book. I have only one criticism and this in no way detracts from the book's factual content. I do find the authors referring to themselves by their first names diminishes the quality of the text. It is inconsistent with how other authors are referred to and at times makes for cumbersome reading. For example (p.31) ". . . Ernest and Professor H. R. Hewer (Hewer and Neal, 1954) found . . ." would flow much better as ". . . Hewer and Neal (1954) found . . .".

The authors are to be congratulated on providing, within so relatively small volume, this comprehensive, up-to-date and authoritative treatise on the natural history of the badger. It is a first class work.

MJD

JACKDAW

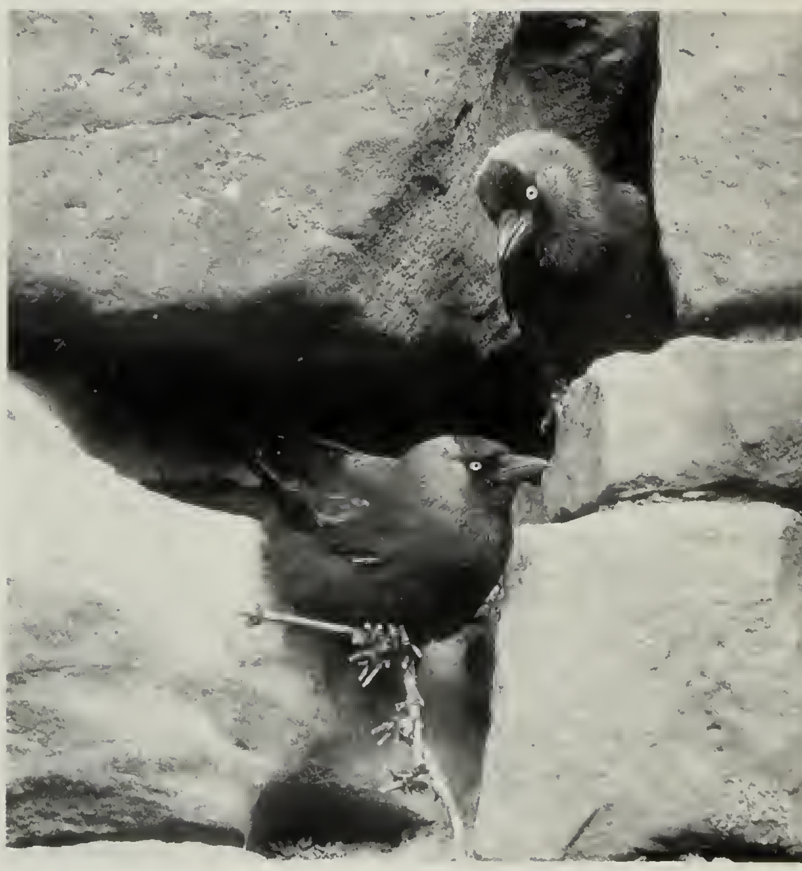

Photo: Richard Vaughan

Flourishing colonies of breeding jackdaws *(Corvus monedula)* have established themselves in the ruined building of the East Mines at High and Low Baring in Rosedale, where this pair was photographed. In neighbouring Farndale jackdaws nest in hollow trees, while in Fryup there are colonies in cliffs. The majority of Yorkshire's jackdaws probably breed in buildings in towns and villages. Although jackdaws are commonly seen in flocks, scrutiny usually reveals that, within the flocks, the birds are in pairs.

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AN ASSESSMENT OF THE DIET OF THE FERAL AMERICAN MINK *MUSTELA VISON* FROM SCATS COLLECTED IN AREAS WHERE WATER VOLES *ARVICOLA TERRESTRIS* OCCUR

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INTRODUCTION

The diet of the American mink *Mustela vison* Schreber is one of great variety both in its native North America and in Europe where a feral population now exists (Dunstone, 1993). Previous studies investigating the diet of mink in Britain have shown that it includes many species of mammals, birds, fish, amphibians, crustaceans and insects (*ibid.*). The water vole *Arvicola terrestris* (L.) was included as a prey species for the mink in only two of these studies, its proportion of the whole diet being reported as only 2% (Day & Linn, 1972) and 1.3% (Chanin & Linn, 1980). Other studies, however, failed to find water vole remains in any of the guts and scats collected (Wise, 1978; Wise *et al.*, 1981; Birks, 1986; Dunstone & Birks, 1987). On the other hand, anecdotal and circumstantial evidence exists which strongly suggests that the mink is a major causal factor in the decline of the water vole in Britain (Jefferies *et al.*, 1989; Strachan & Jefferies, 1993). Thus there is a significant negative association in site occupation by the two species throughout Britain as well as region by region. Also, on a site by site basis where both species occurred, as the signs of mink increased progressively those of water voles decreased in the same way. Finally, there was a marked increase in the rate of loss of occupied water vole sites within the last 10 years, in which time the feral mink population has shown considerable expansion.

If the mink are affecting the water vole populations through predation, then the dietary evidence for the water vole being a significant prey of the mink is obviously lacking. Strachan and Jefferies (1993) suggest that the reason for this discrepancy is that all previous studies of the diet of the mink in Britain were carried out in western areas where water voles were either scarce or absent. This claim is supported by the results of their British survey mapping the distribution of both species.

In order to clarify this point, and to determine whether water voles formed a significant prey item of the mink, the scats of the latter species were collected only from locations where populations of the former were known to occur.

The results of further research on water vole and mink interactions with regard to their distribution and abundance are to be discussed by Strachan *et al.*, (in prep.).

METHOD

Study area

The study was based in the Midlands of England (Derbyshire, Leicestershire, Nottinghamshire and Staffordshire). This area was still found to possess a high density of sites occupied by water voles in the national survey (Strachan & Jefferies, 1993). The locations visited throughout the study were river and canal-side sites of similar habitat quality. All were within the River Trent catchment area (Rivers Blithe, Derwent, Dove, Manifold, Mease, Soar, Sow, Trent, Wreake, Wye and the Trent and Mersey canal).

Determination of the presence of water voles and mink and the collection of mink scats

The presence of both species was established by searching the river banks for fresh field signs. 125 different stretches of river and canal bank (each l-3km in length) were visited during 1993 and 1994.

Water voles mark their territories with latrines and piles of their droppings are scented with an olfactory marker (Stoddart, 1968; Leuze, 1976). These are the most conclusive indicators of their presence. In addition, the bank was searched for the presence of water

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vole burrows and for tracks on mudbanks at the water's edge. If any of these field signs were found, water voles were recorded as being present (Woodroffe *et al.*, 1990a).

The presence of mink was determined by the finding of their distinctive five-toed tracks. Mink scats were found by searching the bank, ledges under bridges, angler's fishing stands, the bases of trees and the crowns of pollarded willows. The dens of mink were also found during these searches. Sometimes these were in burrows but more frequently they were in hollow trees. Subsequent visits to the dens enabled many fresh scats to be collected. It was sometimes difficult to distinguish individual scats at these dens due to their being stuck together or broken. However, these remains were still collected for analysis.

On collection, each scat was individually bagged and a note taken of when and where it was found. The scats were air dried at room temperature and then stored dry until treated prior to examination.

Treatment of scats and calculation of results

Prior to analysis the scats were immersed in a warm, 1% solution of detergent (Dunstone & Birks, 1987) and then left overnight. This caused the scats to swell and dissolved any binding mucus. Also, composite scat lumps fell apart which enabled separation of individual scats. Soil and sand particles stuck to the outside of the scat came away during washing, thus leaving them clean.

The scats were then dried in a ventilated cupboard at 24°C for 48 hrs. After being weighed individually to the nearest 0.05g, the scats were teased apart under a binocular microscope using 10x magnification.

Remains of mammalian prey were identified to species from hair and teeth characteristics (Yalden & Morris, 1990; Teerinck, 1991). Avian prey was identified to the Order, using the features of downy barbules present on feather remains (Day, 1966). Fish remains were identified to family using keys (Maitland, 1972; Conroy, *et al.*, 1993).

Non-food material was removed after first accounting for its bulk for estimation purposes. This included undigested vegetable matter, which it was thought could have been consumed inadvertently with the prey, and balls of matted mink fur, which were assumed to have been swallowed whilst grooming.

The relative proportions of prey types represented were calculated using techniques similar to those used in other mink dietary studies (Day & Linn, 1972; Wise, 1978; Chanin & Linn, 1980; Wise *et al.*, 1981; Birks, 1986; Dunstone & Birks, 1987). Two techniques were used: (i) percentage bulk and (ii) percentage occurrence of prey types. The terms used in this analysis are defined as follows:

(i) Estimated bulk: For each scat the relative proportion (volume) of the remains for each prey type present was estimated to the nearest 10% of the entire scat. Each proportion was then multiplied by the dry weight of the scat to give an estimated dry weight in grams for each item for each scat (Wise, 1978).

% bulk: The estimated bulk values for each prey type were summed for the whole sample of scats and expressed as a percentage of the total dry weight of that sample.

(ii) Occurrence: The number of scats containing remains of each prey type (N.B. scats often contained more than one prey type).

% occurrence: The occurrence of each prey type expressed as a percentage of all occurrences of all prey.

The results using both techniques are listed in Table 1 and compared below. The advantages and disadvantages of the two techniques are then discussed.

In order to show broad seasonal changes in mink diet the results based on the bulk estimates for scats collected in each two month period have been amalgamated for the years 1993 and 1994 and presented in Figure 1. In this figure some of the prey types have been combined for purposes of clarity. Thus, changes in eight important prey groups or species are presented. These are:

(a) Water vole, (b) Common rat *Rattus norvegicus*, (c) Rabbit *Oryctolagus cuniculus*, (d) Small mammal (hedgehog *Erinaceus europaeus*, common shrew *Sorex araneus*, mole

TABLE 1

The relative amounts of prey remains found in mink scats collected from water-side locations where water voles also occurred (see text for definitions)

Prey type			Estimated bulk (g)	% bulk	occ.	% occ.
Mammal species						
Water vole	*Arvicola terrestris*		285.19	**19.88**	324	**16.95**
Common rat	*Rattus norvegicus*		117.93	**8.22**	210	**10.99**
Rabbit	*Oryctolagus cuniculus*		60.68	**4.23**	85	**4.45**
Hedgehog	*Erinaceus europaeus*		8.8	**0.61**	11	**0.58**
Common shrew	*Sorex araneus*		10.78	**0.75**	25	**1.31**
Mole	*Talpa europaea*		19.29	**1.34**	41	**2.14**
Field vole	*Microtus agrestis*		8.79	**0.61**	23	**1.2**
Bank vole	*Clethrionomys glariolus*		8.84	**0.61**	12	**0.63**
Wood mouse	*Apodemus sylvaticus*		10.55	**0.73**	16	**0.84**
		sub total	*530.85*		*747*	
		%		*36.99*		*39.09*
Bird orders						
Gruiformes	(coot and moorhen)		397.35	**27.69**	471	**24.65**
Anseriformes	(duck species)		244.97	**17.07**	275	**14.39**
Passeriformes	(passerines)		6.95	**0.48**	6	**0.31**
Columbiformes	(pigeon)		3.43	**0.24**	5	**0.26**
Unidentified bird			10.42	**0.73**	17	**0.89**
Egg remains			14.77	**1.03**	40	**2.09**
		sub total	*677.89*		*814*	
		%		*47.25*		*42.59*
Fish families						
Cyprinidae			139.72	**9.74**	150	**7.85**
Percidae			32.39	**2.26**	53	**2.77**
Cottidae			20.11	**1.4**	29	**1.52**
Salmonidae			12.65	**0.88**	18	**0.94**
Anguillidae			0.9	**0.06**	11	**0.58**
Gasterostidae			2.03	**0.14**	10	**0.52**
Esocidae			1.15	**0.08**	1	**0.05**
Unidentified fish			12.88	**0.89**	51	**2.67**
		sub total	*221.83*		*323*	
		%		*15.46*		*16.9*
Other prey						
Amphibia			3.45	**0.24**	8	**0.42**
Coleoptera			0.37	**0.02**	9	**0.47**
Hemiptera			0.05	–	3	**0.16**
Odonata			0.18	**0.01**	2	**0.1**
Diptera			trace	–	4	**0.21**
Hymenoptera			0.12	**0.01**	1	**0.05**
		sub total	*4.17*		*27*	
		%		*0.29*		*1.41*
All prey			*1434.74*		*1911*	
%				*99.99*		*99.99*

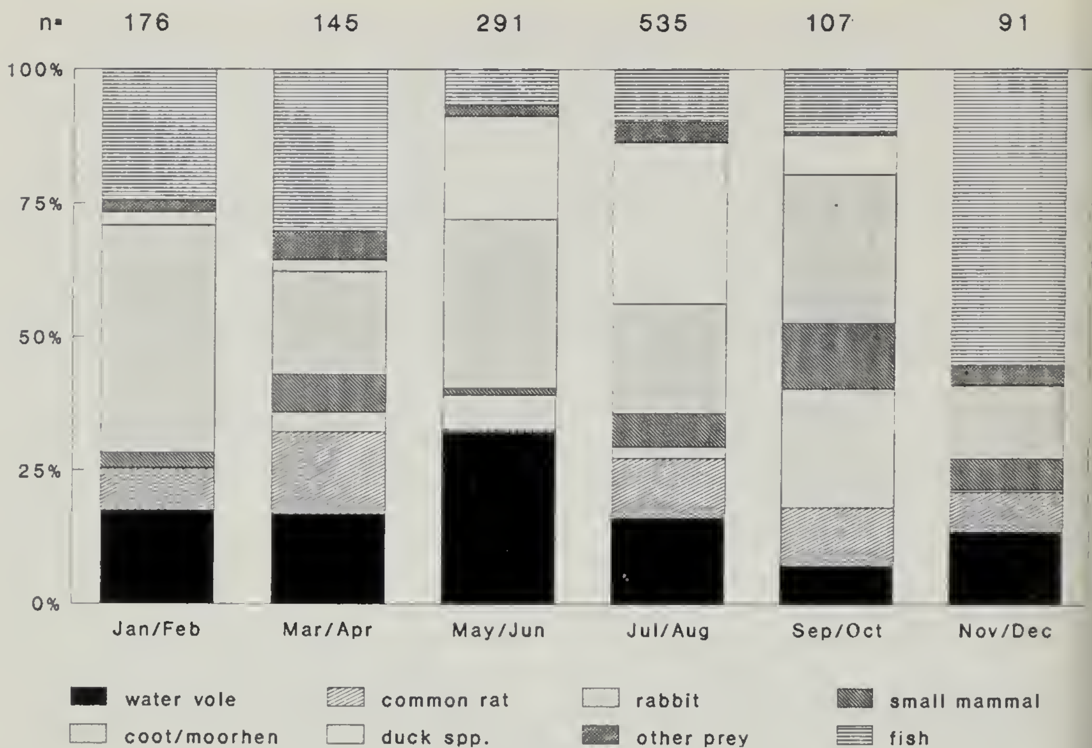

FIGURE 1

Bi-monthly variation in prey remains found in mink scats collected from locations where water voles also occurred. This analysis is based on percentage bulk of remains in the scats from eight prey types (see text for definitions). Numbers heading each column refer to the number of scats anaysed in each bi-monthly period (n= 1345).

Talpa europaea, field vole *Microtus agrestis*, bank vole *Clethrionomys glariolus*, wood mouse *Apodemus sylvaticus*), (e) Coot *Fulica atra* and moorhen *Gallinula chloropus*, (f) All duck species (Anseriformes), (g) All fish species, (h) All other prey not included above.

Results

Number of mink scats located at sites where water vole signs were found

Mink scats were found and collected at 61 of the 125 different locations visited. 26 of these 61 locations also had water vole signs present. In addition, water vole remains were found in 55 scats collected at 6 locations where no water vole signs were found adjacent to the scat collection points. The analyses of these batches of scats have been included in the results, as it was assumed, in these cases, that water voles were present within the foraging range of the mink involved. 1345 usable scats were obtained during the collection period and these were subsequently analysed. The bulk estimate (g and %) and occurrences (no. and %) for each prey type are shown in Table 1.

Constituents of mink diet

Altogether the remains of nine species of mammal were identified in the scats. These constituted more than one third of all remains. However, avian prey were found to constitute the largest part of all remains found. The most frequent bird species were coot and moorhen, which together formed the most important prey type overall. Seven families of fish were represented. The bones and spawn of unidentified amphibian species were occasionally encountered, as were fragments of insects.

The most abundant mammal remains were from the water vole which formed the second most important prey type overall after the Gruiformes. As the latter group was made up of two species, coot and moorhen, the water vole is probably the most important prey species overall in this area of English Midlands. The foraging behaviour of the mink may lead to the water vole being the most likely mammal prey encountered, on the bank and in the water (Dunstone, 1993). Indeed, the methods of capture avoidance employed by the water vole for millennia against native predators (Strachan & Jefferies, 1993) may be useless against the alien mink. The mink is an adept swimmer and the female mink may be small enough to enter the water vole's burrow. Also, as noted by Woodroffe *et al.* (1990b) adult water voles appear to be close to the optimum prey size for adult mink.

The common rat, a prey of similar size to the water vole, was the second most important mammal species. As noted below, this species may have been taken largely in the form of young animals which would be less formidable opponents.

Rabbit remains represented a little over 4% bulk, which is relatively low compared to the results of some other studies (39.4% bulk, Dunstone & Birks, 1987; 41% bulk, Ireland 1988; 15.4% bulk, Wise *et al.* 1981) but is similar to the 3.5% bulk found in a study in the Irish midlands by Ward *et al.* (1986). Studies involving radio-tagged mink have shown that they may 'lie-up' with rabbit kills in burrows away from the water's edge and Birks (1981) has suggested that dietary studies based on scats collected only from water-side sites may therefore tend to underestimate the importance of rabbit. On the other hand, the availability of alternative prey, smaller or more easily caught than rabbit, such as the water vole in the present study area, may also have reduced the consumption of rabbit. All of the above study localities with high rabbit intake are in coastal or western areas where water voles are few. It seems likely from these results that the water vole replaced rabbit in the diet where the former were frequently encountered. Water voles are probably more easily caught. In the Irish midlands study (Ward *et al.*, 1986) where rabbits were few in the mink diet and water voles are absent altogether in Ireland, the Crayfish *Austropotamobius pallipes* was found to be by far the most important prey type.

The remains of hedgehog were found in scats collected on the same day from two dens less than 1km apart. It is possible that these scats were produced by a single mink feeding on a scavenged hedgehog road casualty. The taking of more common shrews than small rodents is remarkable as these are considered distasteful by most predators (Churchfield, 1991; King, 1991).

Coot and moorhen are particularly vulnerable because their usual habits, i.e. favouring the river margins, put them within the mink's normal foraging area (Dunstone, 1993). Duck species too were an important prey, reflecting the vulnerability of aquatic birds in general to predation by mink. The mink is mainly a nocturnal predator (Birks & Linn, 1982) and sitting or roosting bankside birds are most easily taken at night.

The remains of Cyprinid fish species were the most commonly found of all fish remains while Perch *Perca fluviatilis* were the second most important fish. Although this is probably a reflection of relative availability, these species often inhabit shallow waters, near the river margins and amongst emergent and aquatic vegetation. This would make them more vulnerable than mid-channel dwellers such as salmonids. The very low representation of eels *Anguilla anguilla* in the diet is surprising considering they form the otter's *Lutra lutra* favoured fish prey. However, Wise *et al.* (1981) also found that although eels were present in the Rivers Dart and Webburn in Devon they were rarely taken, whereas in Slapton Ley, a eutrophic lake, they formed the second most important fish prey.

The invertebrate component of the diet, though small, appears to have been sought out and eaten intentionally, i.e. rather than taken in the form of gut contents of other prey. The debris from the scats was not sieved for examination for earthworm chaetae, though their presence is a strong possibility (Chanin & Linn, 1980).

Bi-monthly subtotals showed significant variation in dietary composition throughout the year (see Fig 1). Relative availability of different prey types is perhaps the main reason for this variation. However, changes in vulnerability to predation of particular species may

also have an effect. The river-fringe habits of spawning fish make them more vulnerable to predation by mink and this would account for the large proportion of fish (30.16%) in the March/April sample. Fish were the most important component in the November/ December sample (55.21%). This trend was also observed by Wise *et al.* (1981) and Gerell (1967) who suggested that it was perhaps the result of reduced activity of the fish caused by cooler water temperatures making them easier to catch.

The remains of duck in the scats varied greatly between months and was significantly higher in the summer. The majority of ducks would be breeding and the females sitting on eggs at this time and completing the summer moult. There would also be an overall increase in their numbers throughout the summer as young birds hatched and fledged (Sharrock, 1976) and this was observed during the current study. Coot and moorhen were an important prey throughout the year and this suggests that they were always available and always vulnerable. Common rat was a fairly frequent prey throughout most of the year (7.5-15.4%) but featured very little in the May/June sample (0.47%) . A possible reason for this could be that the mink, being an opportunist (Dunstone, 1993), switched to more readily available or more vulnerable prey. The remains of duck species featured very highly at this time (19.27%) as did water vole remains, the latter constituting 32. 2%. The water vole was least represented in the September/October sample (7.1%). In normal circumstances, i.e. without an alien predator, the water vole population would peak in number at this time due to recruitment from successive litters (Singleton, 1984). The low percentage found reflects a decline in the water vole population at the locations where mink also occurred (Strachan *et al.* in prep). At other times the water vole component ranged from 13.57% (Nov/Dec) to 32.2% (May/June). The latter figure is very high for a single species occurring in relatively small numbers.

Comparison of the results from the two techniques of dietary analysis

Dunstone and Birks (1987) carried out a dietary study of coastal living mink in Scotland and also used both bulk estimates and percentage occurrence techniques of faecal examination. This work and the present study provide the means for an interesting comparison of the results from these two techniques.

One of the advantages of the bulk estimate method noted in the present work is that it allows the full use of the information to be gained from the many broken scats. Scats containing fish bones, particularly those of cyprinids, were found to be much more prone to breaking than those containing feathers or mammalian hair and bone remains. Thus, when counted for species occurrence, all the pieces of broken scat had to be recorded as one occurrence per collection. When examined by the bulk technique, on the other hand, the full information from the scat material could be used to denote comparatively high presence of cyprinids. Consequently, percentage bulk of cyprinids in the diet provides a higher figure than does percentage occurrence (see Table 1). This is not so for the other less frequently found families of freshwater fish (with the exception of Esocidae, which occurred only once), where percentage occurrence provided the higher figure and for which fewer broken scats were found. A higher figure for the percentage occurrence of fish, when compared with the percentage bulk estimation figure, was also obtained by Dunstone and Birks (1987) regarding all the sea fish in the coastal mink diet.

Following from the above, an additional advantage in using the estimated bulk technique can be perceived. Full use of all the broken scats avoids a potential bias towards whole scats and hence those containing feathers or mammalian remains rather than those containing fish bones.

Another factor, also noted by Wise (1978), is that calculations based on frequency of occurrence tend to overestimate the presence of small prey and underestimate the presence of large prey in the diet. This can be seen with several prey types in the present study; for instance, consumption of large avian prey, such as coot, moorhen and duck results in a smaller figure for percentage of the diet using the occurrence method than with the bulk method. One of the causes of this bias towards the bulk method is that the dry weight of the

oughage content of avian prey, in these cases bone and feathers, may be relatively high ompared to that of other prey types. A similar result was obtained by Dunstone and Birks 1987) regarding avian prey. On the other hand, very small prey, such as invertebrates, rovided a much greater percentage of the diet when based on occurrence as the dry veights of their remains were very small indeed.

The presence of medium-sized mammalian prey appears to be under-estimated using the ccurrence method, as may be expected. This is so with the water vole in this study and vith the common rat in the study by Dunstone and Birks (1987). However, the presence of ommon rats in the diet in the present study was found to be highest using the percentage ccurrence method. This may indicate that the rats being consumed in these Midlands areas vere young and consequently very small. Small mammal prey (e.g. wood mouse) all ormed a greater proportion of the diet when using the frequency of occurrence technique. his could be expected from the size and has been found in previously studied predator iets (Lockie, 1959; Wise, 1978; Dunstone & Birks, 1987). However, the results for rabbit emains were contrary to those obtained by Lockie (1959) and Dunstone and Birks (1987). hese formed a higher percentage of the diet in this study, when estimated from frequency f occurrence than when estimated from bulk. Part of this difference may be due to rabbit emains being present with another prey type in 36 out of the 85 scats containing them. his could have affected the weight of the scat relative to the bulk of the rabbit remains.

Overall, analysis by the bulk estimation technique would seem slightly preferable but the ose similarity of the results obtained using the two techniques provides mutual validation.

Note that the results obtained from the two techniques discussed here represent prey ems taken and their frequency and not the weight of each prey in the diet of the mink. everal workers have attempted to calculate correction factors based on feeding trials with ptive animals. However, there is such a wide variation in the values obtained regarding e amount of undigestible remains that authors continue to use the uncorrected figures Dunstone 1993).

ISCUSSION

Selective collection and analysis of mink scats from areas where water voles occurred s shown that the water vole is indeed an important component in the diet of the mink. e small proportion of water voles in the mink diets calculated by Day and Linn (1972) d Chanin and Linn (1980) could have resulted therefore from limited water vole ailability in the areas of their studies. The tendency for the mink to utilise many different ecies of prey as shown by this and other British studies (Wise, 1978; Wise *et al.*, 1981; rks, 1986; Dunstone & Birks, 1987), enables the mink to survive irrespective of changes the availability of particular prey species. The inclusion of water vole remains in scats llected where no water vole signs were found in the current study suggests that either the ater voles were leaving no signs in these areas or, more likely, that the mink had foraged r food in adjacent areas where the water vole was present, perhaps foraging specifically r the water vole. The mink could therefore be the water vole's most important predator.

Water voles were found to feature most highly in the mink diet in the first half of the ar (17.5% bulk, Jan/Feb; 16.9% bulk Mar/Apr; 32.2% bulk, May/Jun). Water voles born one year will seldom breed that year but make up the breeding population of the colony the following April (Stoddart, 1968; Boyce, 1991). Thus, by preying on these important er-wintered individuals (from January to April), the mink provides a serious threat to ter vole colonies by not only removing some of the young individuals, but removing the v surviving breeding stock. This could have serious consequences for the long-term vival of the predated populations.

Evidence collected by Jefferies *et al.*, (1989) and Strachan and Jefferies (1993) plicating the mink in losses of water vole colonies all over Britain is therefore ostantiated by the findings of the present study. These findings show that the losses noted not due to emigration of the colonies on the approach of mink, but to their elimination predation to extinction. These local losses of water vole colonies lead to fragmentation

of the distribution of the British water vole population. Colony isolation increases the vulnerability of the species to further predation and to other factors contributing to the overall population decline, such as habitat change and pollution (Strachan & Jefferies, 1993).

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LABRADOR TEA *LEDUM GROENLANDICUM* IN THE PEAK DISTRICT

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Introduction

The Labrador Tea, *Ledum groenlandicum* Oeder, is an intriguing plant, "a rare escape whose establishment on high and remote moorland in the north of the county is of considerable interest" (Clapham, 1969: 237). It is the only moorland plant in the Peak District to be listed in the *British Red Data Book: Vascular Plants* (Perring & Farrell, 1977, 1983), because it is known from fewer than 20 ten-kilometre squares in Britain, though as a reputed introduction it is not regarded as a high conservation priority. As a result of making numerous enquiries and extensive walking over 20 years, there are now seven sites known to me in the Dark Peak, all of them in remarkably remote places. This note is intended to put this distribution on record, and to discuss the likely sources of these plants.

Identity

The European *Ledum* is *L. palustre*, known from northern Europe eastwards across the Palaearctic region to Japan and possibly to Alaska. Perhaps understandably, British plants have been so named, and this species has been correctly recorded from Lecropt Moss, Stirling (Ribbons, 1976). Other records, including certainly all those from the Peak District, seem to be *L. groenlandicum*, which has broader, shorter leaves (about 3 times as long as broad) and 8 stamens; *L. palustre* has leaves *c.* 8 times as long as their breadth, and 10 stamens (Ribbons, 1976). The difference in chromosome number reported by Ribbons (1976) is not so reliable however; he reported that *L. groenlandicum* is diploid with 2n = 26, while *L. palustre* is tetraploid with 2n = 52. Dr Hugh McAllister has studied this question, and has specimens from around the world in cultivation at the Ness Botanic Gardens of Liverpool University, in the Wirral. He reports (1973, and *pers comm.* 1978, 1995) that there are two forms of *L. groenlandicum* in North America, a more southerly form with, indeed, 2n = 26 but a more northerly form which has 2n = 52. He reports morphological differences between the two as well, the more northern form having smaller leaves and a depressed apex to the ovoid capsules whereas the southern form has larger leaves and spindle-shaped capsules which taper into the style. His interest in these features was prompted by his discovery that the Flander's Moss, Stirling/Perth *Ledum* had 2n = 52 Chromosomes have been counted from some of the Peak District plants (unpublished data);

morphologically they all match the 2n = 52 form, and those which have been examined (including the Long Ridge Moss, Barrow Stones and Chew Reservoir plants, see Table 1) have 2n = 52. Thus the Peak District *Ledum* seem to be the northern form of *L. groenlandicum*.

There is a taxonomic footnote to this story: *Ledum* is now considered to be a subsection of the larger genus *Rhododendron*, and should therefore formally be *Rhododendron groenlandicum* (Harmaja, 1990, 1991). For clarity in this account, *Ledum* will be maintained as the generic name.

TABLE 1
The Sites for *Ledum groenlandicum* in the Peak District.
Altitudes and nearest neighbour/track/path distances are taken from the OS 1:25000 map.
Tracks are those negotiable with a land-rover, paths are footpaths.

Site	Grid Ref.	Alt (m)	Peat Depth (m)	Size E-W (m)	Size N-S (m)	Nearest Neighbour (m)	Nearest Track (m)	Nearest Path (m)
Chew Resvr.	SE038027	503	2	3	2	380	800	450
Long Ridge Moss	SE042026	501	2	4	4	380	925	300
Torside Grain	SK081971	512	2.5	3	2	2775	1600	450
Near Black Clough	SK107980	523	2	3	3	2750	1525	80
Barrow Stones	SK131967	592	3	6	4	1675	1500	775
Dean Head Stones	SK140981	490	?	3	2.5	1675	1625	150
Outer Edge	SK180970	529	3	5	4	4150	1500	300

Distribution

All the Peak District sites were revisited in August 1995, to ensure standard descriptions of the plants and their sites. Grid references were carefully checked against nearer and further landmarks using the newer (1987 edition) of the Ordnance Survey 1:25,000 Outdoor Leisure Map of the Dark Peak area; this shows cloughs and contours with much greater accuracy than the earlier (1972) edition (Table 1). The decision to publish the precise grid references has been taken, after some discussion, on the grounds that (1) the plant is not actually likely to attract collectors (2) even with 6-figure grid references it requires some determination to find them (3) interested naturalists will be better able to judge whether they have discovered a new site if the existing sites are published.

To categorise the community in which each plant is found, twelve quadrats, each 0.1m^2, were placed at 1, 3, and 5m to the north, east, south and west of the edge of each plant. The percentage cover of each plant in each quadrat was estimated by eye, and the mean value for the twelve quadrats is entered in Table 2. Distances from landmarks and the sizes of the clumps were estimated by pacing (my paces being about 1m); the irregular shapes of plants and the rough terrain rendered any attempt at greater accuracy spurious.

Three of the sites are published. Ribbons (1976) quotes Allen (1934) as finding "a good plant of *Ledum* covering some two square yards" on the Greenfield Moors in South-west

Yorkshire, VC63. I believe this is the plant on Long Ridge Moss (SE043026) though it is now in Greater Manchester. When first seen by me, on 12/1/80, this was an old plant which had grown apart into three separate plants, the dead stems being left in a bare area in the middle.

In 1995, it is still essentially unchanged: overall it covers 4m x 4m, the smaller sections being *c.* 1m x 1m and 1.5m x 1.5m within that while the larger part is 2m x 4m. A dead stem in the middle had about 35 annual rings in it, and was a side stem of a much larger "trunk" which I recall seeing in 1989. It bore no fruits in 1995, but did so in January 1991.

The best known plant is the one near Barrow Stones, mentioned by Clapham (1969). Ribbons (1976) says that "a thick patch of *Ledum* some 2m square was discovered there in 1949, probably by Dr W. A. Richardson". Local knowledge suggests that in fact the Duke of Devonshire's gamekeeper E. H. Peat, a well known naturalist, actually found it (Mrs M. Heardman, *in litt.* 23/2/92). This plant now covers about 6m x 4m, and seems to have changed little in 20 years (Ribbons quotes one source describing it as 8-10m in diameter, but that must surely be a mistake for 8-10 feet). However, a well-walked path has developed along the watershed here, and by 1988 was damaging the uphill side of the clump, separating off a patch about 30cm across. Concerned about this threat to the plant, I transplanted two small stems into nearby wet peat haggs, and one of them took so that a subsidiary clump, 50cm in diameter, located 12m west, was noted in 1991. In 1995, it is 1m x 1m, and has fruited, as has the main clump. In the meantime, the path has been partially diverted, and the uphill side of the main clump is recovering. Another daughter plant has been reported, some distance south (Mrs M. Heardman *in litt.*), which may be another attempt at a safeguard, but I have failed to relocate it.

A third plant "near the Shepherd's Meeting Stones" has been briefly mentioned by Band (1975) and Anderson and Shimwell (1981). In fact it is nearer the Dean Head Stones. This is a low growing, semi-prostrate plant that looks rather unlike the other examples, but it is at the edge of a cotton-grass plain where the ground slopes up into a heather-covered ridge, and it may be a drier site than the others. Mrs M. Heardman, to whom I am grateful for proper directions to this plant, remarked that it appeared to be dying out in 1967, but it was healthy when she revisited it in 1990, as it is now. She says it was found, by chance, by two walkers in the 1950s. This plant has not fruited in 1995, and may never have been recorded flowering or fruiting; however, the flowering period, in June, coincides with other field work, and this negative information should be taken cautiously.

Only 380m away to the WNW from the plant on Long Ridge Moss is an isolated *Ledum* which makes a tall conspicuous dome on an otherwise featureless expanse of cotton-grass. Described in my notes as an oval clump 2.3m x 2m on 12/1/80, it is now 2m x 3m. More interestingly, alone of the Peak District plants, it appears now to be reproducing naturally. On 12/1/91, I noted a single subsidiary plant *c.* 1m away to the east. In 1995, there are at least 15 satellite plants, of various sizes from single sprigs to a bush 80cm x 30cm. They are mostly to the west and north, though one is 6m away to the ENE. The large plant has fruited well in 1995, and so have three of the satellites: the fruits are noticeably absent from the more exposed SE side of the main plant, but abundant on the west and north.

Similar plants, conspicuous domes visible from more than 200m away, are present at near Black Clough and Outer Edge. Both are in wet *Calluna* moor, near its upper limit where it grades into *Eriophorum vaginatum* bog. A Peak Park ranger told me of the former in 1988, while I found the latter by chance in 1982. Both have fruited, but sparsely, in 1995.

At the final site, unlike the others, the *Ledum* is almost hidden in a peat gulley running into Torside Grain, and cannot be seen from any distance. Perhaps as a result of its more sheltered site, this plant has flowered and fruited profusely in 1995. This site too was described to me by a Peak Park ranger in 1988. These sites are listed in Table 1.

Judging from the depths of peat exposed in nearby cloughs, all these sites are on peat 2-[illegible]m deep, though the Torside Grain plant, because it is in a gulley, is itself only growing over about 1m depth of peat, and the Dean Head Stones plant may also be on shallower

peat (see above). All are particularly remote sites, the nearest of any to a landrover-track being 800m away (Table 1), while the nearest to a tarmac road is 1775m from it. More significant is their altitude, with the lowest at 490m and the highest at 592m; all require a fair climb from any access point. The current leisure map suggests that footpaths now pass quite close to most of the sites, but this is a development of the last 30 years; ridge paths have developed along most of the watersheds, and the Pennine Way (which passes 450m away from one plant) was only opened in 1967. In the past (and all the main plants are surely more than 30 years old) they must have been even more remote. It would be hard to pick a more remote site anywhere on these moors than Barrow Stones.

The nearest reported sites for *Ledum* outside the Peak District are at Soyland Moor and Saltersley Moss (Ribbons, 1976), on Danes Moss (Newton, 1971) and in West Yorkshire (Lavin & Wilmore, 1994). Soyland Moor, in Yorkshire about 18km NW of the Chew Reservoir sites, is also a remote high altitude site, but the plant discovered there in 1917 seems not to have been seen since 1925. On one brief visit I failed to locate it, but the habitat has degenerated from the days when this was a good grouse moor. Saltersley Moss is a lowland site near Wilmslow in Cheshire, about 30km from the nearest Peak District plants, but the site was lost and the *Ledum* destroyed in 1966 to peat extraction (Newton, 1971). Danes Moss is near Macclesfield, Cheshire, and is a reserve of the Cheshire Wildlife Trust; it is also a lowland site about 30km from the Peak District plants. The plant in West Yorkshire is in heather moorland, about 35km north of the Chew Reservoir plant (H. McAllister, *pers. comm.* 1995). The other seven sites listed by Ribbons, in central Scotland, around the Solway Firth, in West Lancashire and in Westmoreland, are all lowland mosses.

TABLE 2
Vegetation associated with *Ledum groenlandicum* in the Peak District.
Each value is the % cover averaged over 12 quadrats; p = present.

Site	*Eriophorum vaginatum*	*Eriophorum angustifolium*	*Deschampsia flexuosa*	*Empetrum nigrum*	*Calluna vulgaris*	*Vaccinium mytrillus*	*Rubus chamaemorus*	bare
Chew Resvr.	60	12	–	2	–	2	–	24
Long Ridge Moss	10	11	9	32	–	–	p	38
Torside Grain	–	4	3	–	10	23	–	60
Near Black Clough	7	6	–	4	58	2	–	23
Barrow Stones	9	p	1	33	–	15	–	41
Dean Head Stones	25	3	–	34	20	–	19	–
Outer Edge	1	4	–	23	55	2	8	8

Community Associations

The plants most regularly associated with *Ledum* in the Peak District are *Eriophorum vaginatum, E. angustifolium*, and *Empetrum nigrum* (Table 2). *Calluna vulgaris, Vaccinium myrtillus, Rubus chamaemorus* and *Deschampsia flexuosa* are present at some sites but absent at others. These are all typical members of the deep peat blanket-bog

communities in the Peak District, and the poverty of the flora is equally characteristic (Anderson & Shimwell, 1981). Bare peat, either as peat pools, and a sign of the wetness of the habitat, or as the sides of erosion gulleys, is also frequent. The plant is mildly aromatic, and is presumably distasteful to browsing mammals. There are no signs of browsing damage at any time of the year, though Mountain Hares *Lepus timidus* regularly shelter in the lee of the plants, to judge from the droppings frequently present.

Discussion

The most interesting question about this plant is its origin. It is usually dismissed with the apellation "introduced", sometimes more precisely "it was, of course, planted there" with which Druce (1927) dismissed the Soyland Moor plant (as quoted by Ribbons, 1976). There seems little doubt that the plant has been introduced to some sites, probably accidentally from specialist nurseries or botanic gardens. Clapham (1969) mentions one other site in Derbyshire, the site of an old nursery at Whitesprings on Beeley Moor. Derby County Museum records suggest that there were two sites here, and I saw the plant at one of them in flower in 1980. The following year, however, it had been destroyed by the excavation of a flight pond for wild ducks. However, this site also had well established *Gaultheria shallon* and *Pernettya mucronata*; these are both berry-bearing members of the Ericaceae, which make useful game cover and are often planted deliberately. All three may have escaped, or been deliberately planted, but it is hard to see any value in planting *Ledum*; it has dry capsules which offer little food to any game bird, and does not provide particularly good cover either. Of the other *Ledum* sites mentioned by Ribbons (1976), that at Normandy, Surrey, is also thought to have been deliberately planted. It is very difficult to believe that any of the sites on the Peak District moors could have been planted deliberately. Even a determined gamekeeper would surely have found suitable sites to try nearer to his cottage than these, and any history of using this species as game cover would surely have produced some examples nearer to tracks and houses.

Rhododendron ponticum, which certainly has been used as game cover, is frequent still in the neighbourhood of estate houses, and sometimes is spreading onto the moors, but is rarely more than a kilometre from its source (Rotherham, 1986).

If it is very unlikely for *Ledum* to have been planted deliberately in or near its Peak District sites, it is still possible that it reached them accidentally from gardens or nurseries. Although it has been in cultivation in Europe since 1763 (Ribbons, 1976), it is not a common garden plant, and is likely to be found only in specialist collections. Its seeds are very small, probably wind-dispersed, and could perhaps be blown onto the moors. There is a single plant of *Rhododendron ponticum* on the moor between the two *Ledum* near Chew Reservoir (contradicting my comments above), but possible sources are about 2km away to the west around Ashway House and the Dovestone Reservoir complex. McAllister (*pers. comm.*) speculates further that seed might be blown all the way from Greenland, but this is not the predominant wind direction; moreover, if seed could be blown all the way from North America, then it could logically come more readily from some nursery or botanic garden in Lancashire or Cheshire.

The possibility that birds have carried seeds, either in their guts or on their feet, has also been discussed. The sites for *Ledum* in central Scotland, around the Solway Firth and in West Lancashire (Ribbons, 1976) are wet lowland areas. As such, they might make suitable sites for migrating geese; among species which are known to breed in northern Greenland and winter in Britain are Greenland White-fronted Geese *Anser albifrons*, Pink-footed Geese *A. brachyrhynchus*, Brent Geese *Branta bernicla*, and Barnacle Geese *B. leucopsis*. These sometimes migrate non-stop from their breeding grounds to their wintering grounds in Britain, so are plausible carriers of seed, in their guts or on their feet. However they usually stage through Iceland (Cramp, 1977), and *Ledum* is not known from Iceland. Geese would not visit high moorlands. McAllister (1973) suggested the Meadow Pipit *Anthus pratensis* as a carrier, but though this is a common moorland bird, and does migrate through Britain to and from Iceland and SE Greenland, it does not occur in northern or

western Greenland where *Ledum* grows (Cramp, 1988). Moreover, on autumn migration, birds from Greenland stage through Iceland. A more likely candidate is the Greenland race of the Wheatear *Oenanthe oenanthe leucorrhoa*. This small passerine does breed widely throughout northern Greenland and Canada (Cramp, 1988); more remarkably, there is good evidence, for instance from occurrences on ships well out to sea, that it usually undertakes its autumn migration directly from its breeding grounds in Greenland to western Europe (Snow, 1953). It is quite often seen on the moors in autumn; indeed there was a party of three at the Barrow Stones in August 1995, feeding up on berries of *Empetrum*. While this does not constitute proof that they transport *Ledum* seed from North America, it is at least a biologically plausible route. Some modest research into the relative sizes and mobilities of *Rhododendron* and *Ledum* seeds would be informative, and it would be interesting to know from bird-ringers whether small seeds can be recovered from the legs or guts of newly-arrived migrant birds.

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STUDIES OF DAUBENTON'S BAT *MYOTIS DAUBENTONI* (KUHL) AT KEXBY BRIDGE, NORTH YORKSHIRE: SEASONAL AND ANNUAL FLUCTUATIONS IN NUMBERS, AND FACTORS AFFECTING EMERGENCE TIMES

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INTRODUCTION

There is at present a growing concern about the dwindling numbers of all species of British and European bats (e.g. Stebbings, 1988; Stebbings & Griffith, 1988). The decline has been monitored since 1978 by the National Annual Bat Colony Survey (NABCS) organised by Dr R. E. Stebbings (The Robert Stebbings Consultancy Ltd., 74 Alexandra Road, Peterborough, Cambridgeshire PE1 3DG). The standard procedure now adopted is to ask observers to count the numbers of bats emerging from specific colonies at least twice during June, before the young of the year are assumed to be on the wing. The precision with which these counts assess the population size in any year might be expected to depend on a number of factors, for example, weather conditions on the survey days and/or the relative advancement or retardation of the reproductive cycle, which will, in turn, reflect directly or indirectly climatic conditions prior to the counts. The precise number and locations of colonies contributing to the NABCS vary from year to year, adding yet more statistical "noise" to the data.

Since 1983 counts have been made of Daubenton's bat (*Myotis daubentoni* (Kuhl)) emerging from a nursery roost occupying a stone river bridge at Kexby, on the border between North Yorkshire and North Humberside (SE705511). The work reported here was initiated (a) to monitor the changes in bat numbers at this roost over a whole summer season, the first detailed study of its kind on this species in Yorkshire, and (b), as a result of the data gathered, to ascertain the value of three counts during June as a measure of the population present. In addition, we examine counts from this single colony made over a 12-year period in order to detect long-term trends in population size.

METHODS

The Daubenton's colony at Kexby Bridge was monitored by four teams on 29 occasions during 1995. Counts at approximately weekly intervals commenced on 26 March and ended on 8 October. The old road bridge across the River Derwent at Kexby is constructed of large limestone blocks. When the present study started, the known roost occupied space behind one of these blocks, which had become displaced outwards, on the south-eastern (downstream) side of the bridge approximately 4m above the water surface. On each monitoring occasion times of emergence of first and last bats (BST, 24 hour clock), and their number, were noted. A bat was assumed to be the last if no further individual emerged over a ten minute period. Temperature (°C), cloud cover (%), wind speed (nil, slight, moderate, strong) and wind direction (8 compass points) were also recorded according to set protocols. Days with heavy rain were avoided. For statistical analysis, days are numbered from 26 March (counted as day 0). During this study two additional roosts were discovered, one in a crack beneath the western arch and the other in the "roof" of the eastern buttress on the north-western (upstream) side of the bridge. Sunset times were taken from the Yorkshire Evening Press daily newspaper and interpolated for Sundays where necessary.

On two occasions during the study period, small samples of bats were netted, from the south-eastern roost on 31 May and from the under-arch roost on 4 August.

Results

In 1995, the first bats were recorded at the south-eastern roost on 12 May and the last seen in the vicinity of the bridge on *c.* 8 October. Full information on bat numbers, emergence times and environmental variables are given in Table 1.

TABLE 1
Observations on Daubenton's bats at Kexby Bridge, 1995 – Raw data.

Obser	Day	Month	No. bats	Temp	Wind. d	Wind. s	Cloud %.	Sunset	First	Last
1	26	3	0	9	5	3	100	19.28	–	–
1	1	4	0	11	6	2	25	19.39	–	–
2	9	4	0	11.5	7	1.5	100	19.54	–	–
3	15	4	0	11	6	2	50	20.05	–	–
1	21	4	0	6	1	1	25	20.16	–	–
4	29	4	0	10	3	1	100	20.31	–	–
2	2	5	0	13	4	1	60	20.37	–	–
3	12	5	14	3	1	2	30	20.55	21.35	22.05
1	19	5	67	7	5	1.5	35	21.06	21.38	22.13
4	26	5	81	17	5	1.5	70	21.17	21.44	22.11
2	31	5	92	11	7	1	20	21.24	21.47	23.13
3	10	6	101	16	6	1	–	21.34	21.55	22.15
1	16	6	79	13	6	1	100	21.38	22.05	22.50
4	24	6	61	14	1	2	100	21.41	22.06	22.40
2	1	7	58	15	7	1	100	21.39	21.50	22.35
3	7	7	67	19	6	1	70	21.36	21.45	22.20
1	15	7	101	16	5	1	5	21.29	22.00	22.45
4	19	7	21	24	5	1	15	21.24	21.46	22.06
2	24	7	0	16	–	–	10	21.17	21.43	–
3	4	8	61	18.5	1	1	80	20.58	21.32	21.57
1,2,3	12	8	60	–	–	–	–	–	–	–
1	19	8	26	19	–	0	0	20.28	20.46	–
4	27	8	-	11	7	1	10	20.08	20.43	–
3	30	8	6	20	1	1	100	20.00	20.30	–
1	9	9	4	15	–	0	30	19.37	20.00	–
4	16	9	-	14	1	1	80	19.19	–	–
1	24	9	2	8	7	2.5	90	19.00	19.33	–
2	30	9	1	11	3	1	100	18.45	19.02	–
4	8	10	–	19	5	2	0	18.27	19.00	–

Legend to Table 1:

obser	Observer – 1 = Oxfords; 2 = Lane, 3 = Moodies; 4 = Drewett
wind.d	Wind direction where 0 = N, 1 = NE, 2 = E etc.
wind.s	Wind speed where 0 = no wind, 1 = slight breeze, 2 = moderate, 3 = strong
first	Time of first bat out (hrs. mins)
last	Time of last bat out (hrs. mins)
–	Data not available

Emergence times

There is a very clear relationship between the time the first bat emerged on each occasion and sunset (Fig. 1). Until 19 July bats were counted out of the south-eastern roost, but after this time they moved to other roosts within the bridge (see below) and "first emergence" was recorded as when the first bat was detected flying over the river. This change in criterion seems to have made no difference to recorded emergence time in relation to sunset (Fig. 1). On average, bats emerged 26 minutes after sunset with a range of 9-40 minutes (95% confidence interval of the mean, 24 to 28 minutes).

The regression of time of first emergence on time of sunset (Fig. 2) was highly significant ($P<<0.001$) with over 98% of the variance in emergence time explained by the relationship ($r^2 = 0.984$). Nevertheless, it is of interest to ask whether some of the remaining, unexplained variation is attributable to any of the environmental factors measured. Differences between first emergence and sunset times (emergence delay) were regressed against temperature, wind direction, wind speed and cloud cover. A negative relationship between emergence delay and temperature was suggested (Fig. 3), but this was not formally statistically significant. The trend is for the delay to be longer on colder nights. This negative trend is heavily reliant on data from three or four nights of low temperatures which, not surprisingly, occurred at the beginning and end of the bat flying season. Clearly there may have been other reasons for a longer emergence delay at these times. A significant positive relationship ($P<0.05$) was found between emergence delay and wind speed, with bats emerging relatively earlier in less blustery conditions (Fig. 4). No associations were found between emergence delay and cloud cover or wind direction.

Rate of emergence

On three occasions, 19 May, 16 June and 15 July, numbers of bats emerging from the south-facing roost were counted over five minute intervals. The rates of emergence are shown in Fig. 5. On each date, rate of emergence was slow at first, rising to a peak after 10-15 minutes and then gradually declining. The distribution in May was symmetrical with all bats emerging within a 30 minutes period. In June and July the decline in emergence rate after the initial peak was much more protracted, taking 60 minutes in total. The data from May were collected only seven days after the first bats were recorded emerging from the bridge, and presumably represent adult females in an early stage of pregnancy. In June the emerging bats would have included heavily pregnant females and in July both adults and juveniles. A change in the reproductive status of the colony may therefore explain the long "tail" in the emergence profiles on the last two dates.

Number of bats

Fig. 6 shows the total number of bats counted on each occasion. Although Daubenton's bats were seen feeding over the river on 2 May they were apparently arriving from upstream. The first recorded emergence from the south-eastern roost was on 12 May. Numbers built to a peak of 101 on 10 June, declined to *c.*60 at the end of June and rose again to 101 on 15 July. Four days later numbers of bats emerging from this roost had declined to 21 and five days later still the roost was totally abandoned (Fig. 6). Bats were still foraging over the river in some numbers so another roost site within the bridge was sought, and found to be under the western arch. An accurate emergence count was only possible from a strategically moored boat; this was achieved on 4 and 12 August when 61 and 60 bats, respectively, were recorded. On 19 August a third roost in the eastern buttress was discovered and twenty-six bats counted out. Subsequently bats were detected feeding over the river but, as a result of the unavailability of a boat, were not attributable to a specific roost site. It is highly likely that the foraging bats originating from the bridge as their time of first detection matched the emergence delay established previously. Numbers of feeding bats were estimated on some occasions as a crude measure of roost size. A single Daubenton's bat was recorded on 8 October, the last date of the survey. After this time, it was assumed that bats had dispersed to other roosts and were unlikely to overwinter in the bridge. The river in spate occasionally floods to the level of the known roost sites.

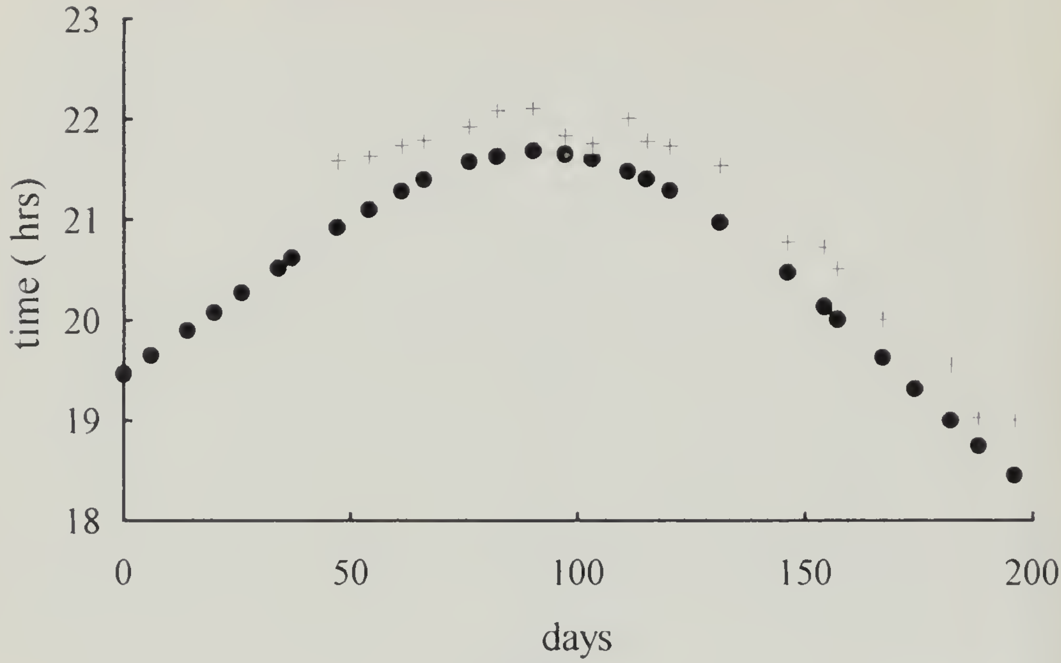

FIGURE 1
Time of sunset (dots) and time of first bat emergence (+) plotted against days (26 March = day 0).

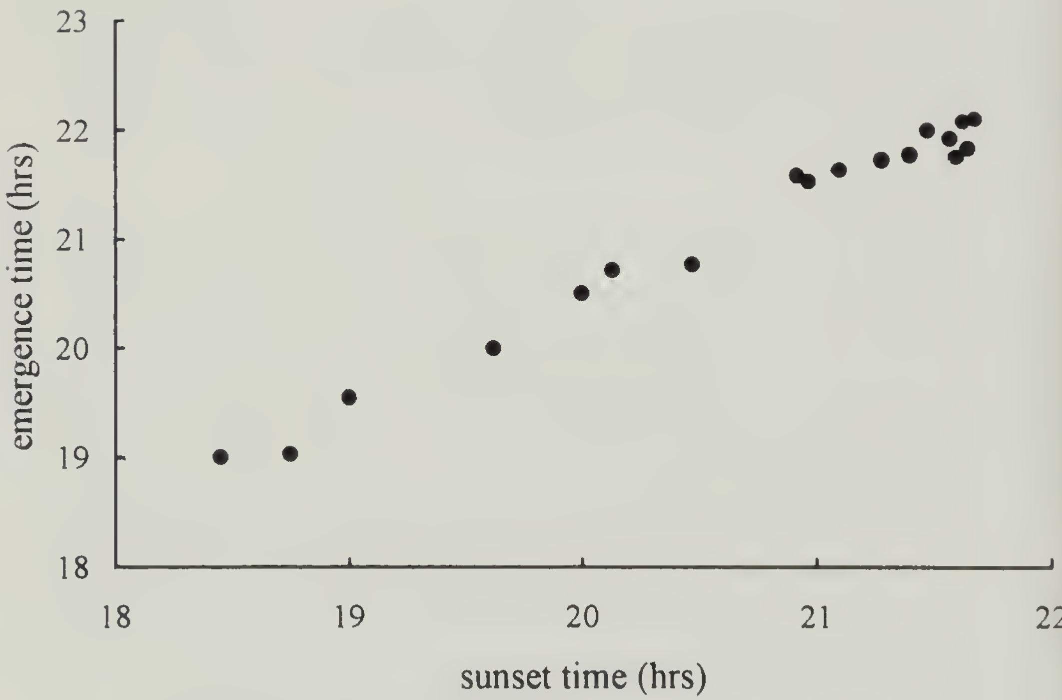

FIGURE 2
Time of emergence of first bat plotted against time of sunset.

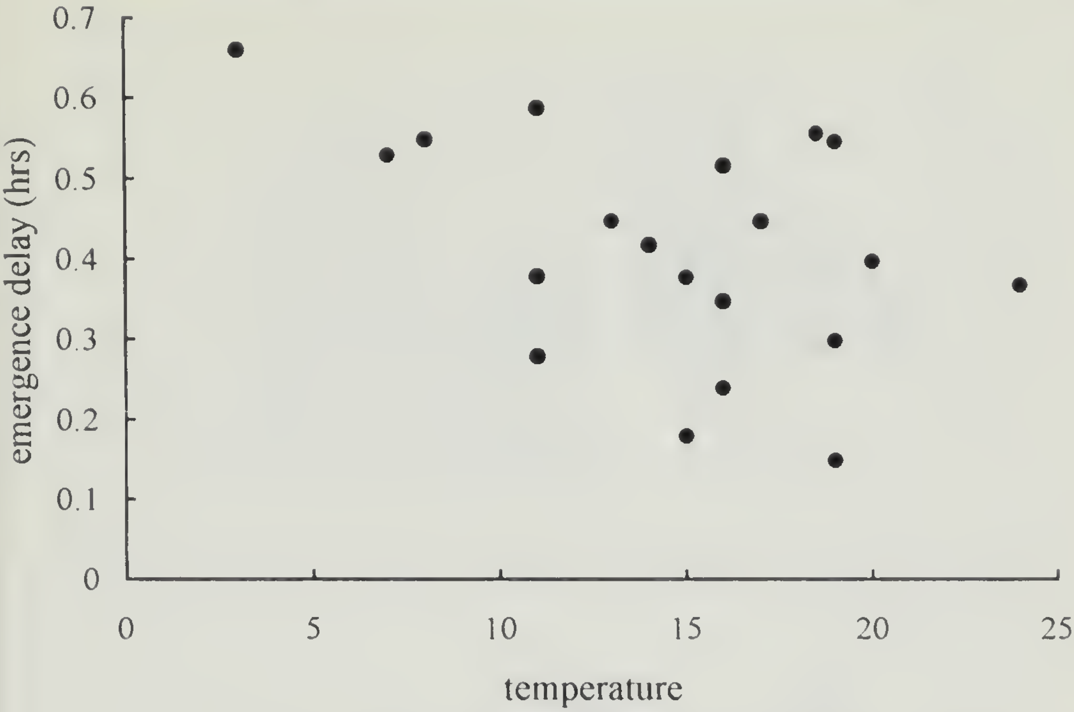

FIGURE 3
Emergence delay (as time after sunset) plotted against temperature (°C).

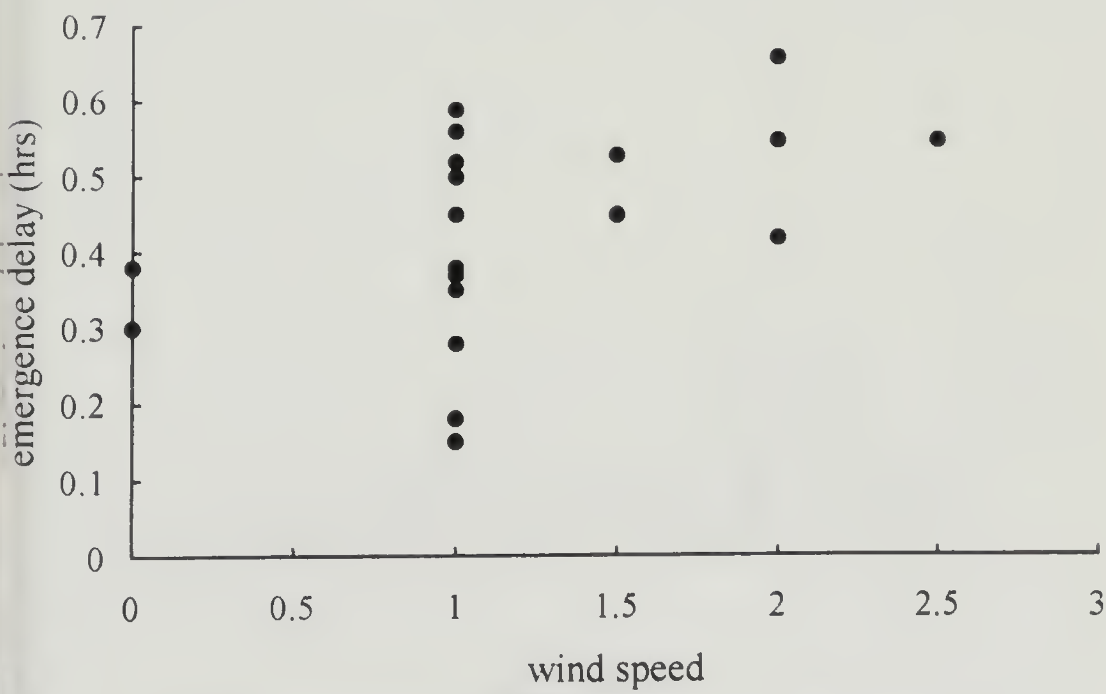

FIGURE 4
Emergence delay (as time after sunset) plotted against wind speed.

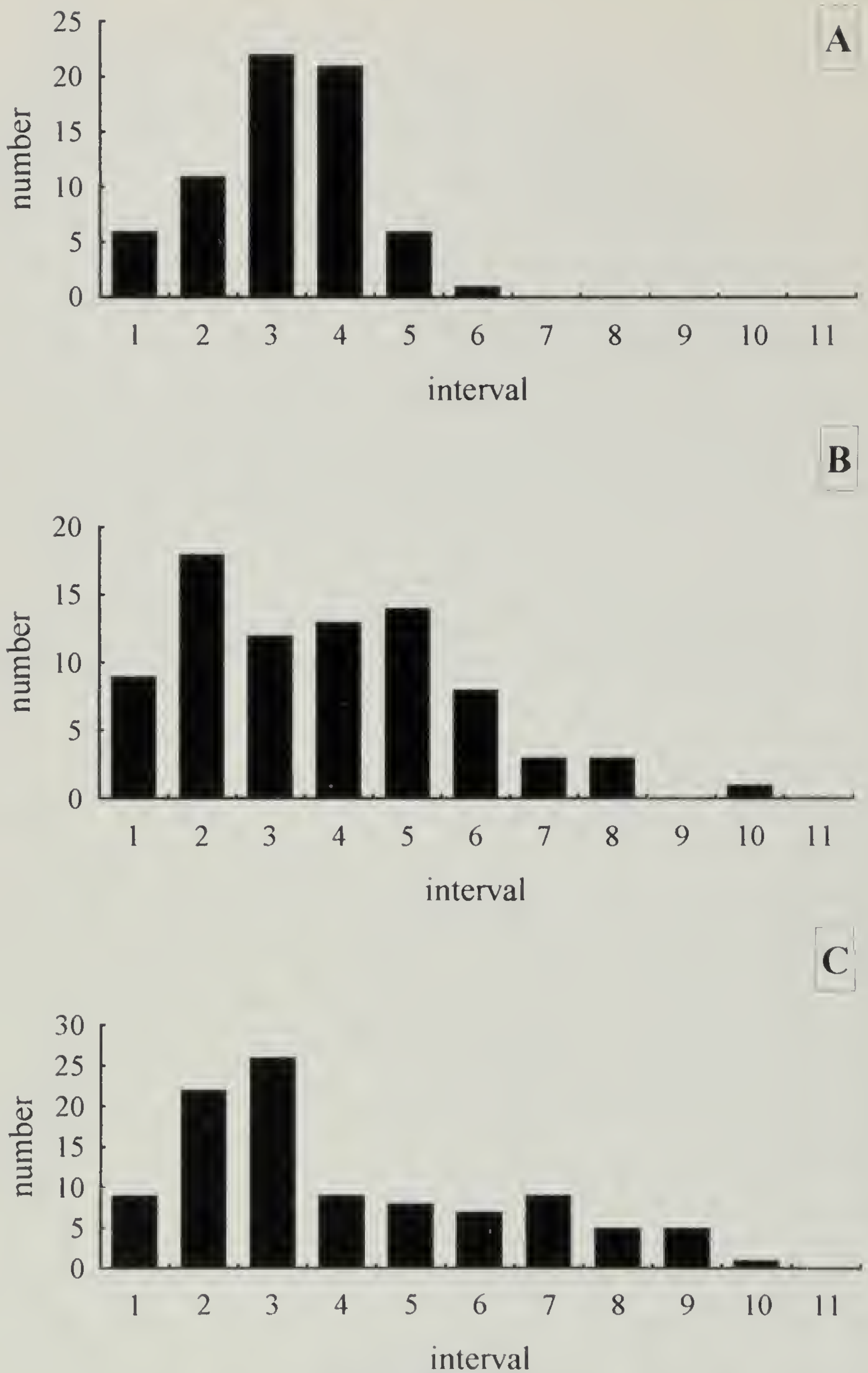

FIGURE 5
Emergence profiles on three dates recorded at 5 minute intervals.
A – 19 May; B – 16 June; C – 15 July.

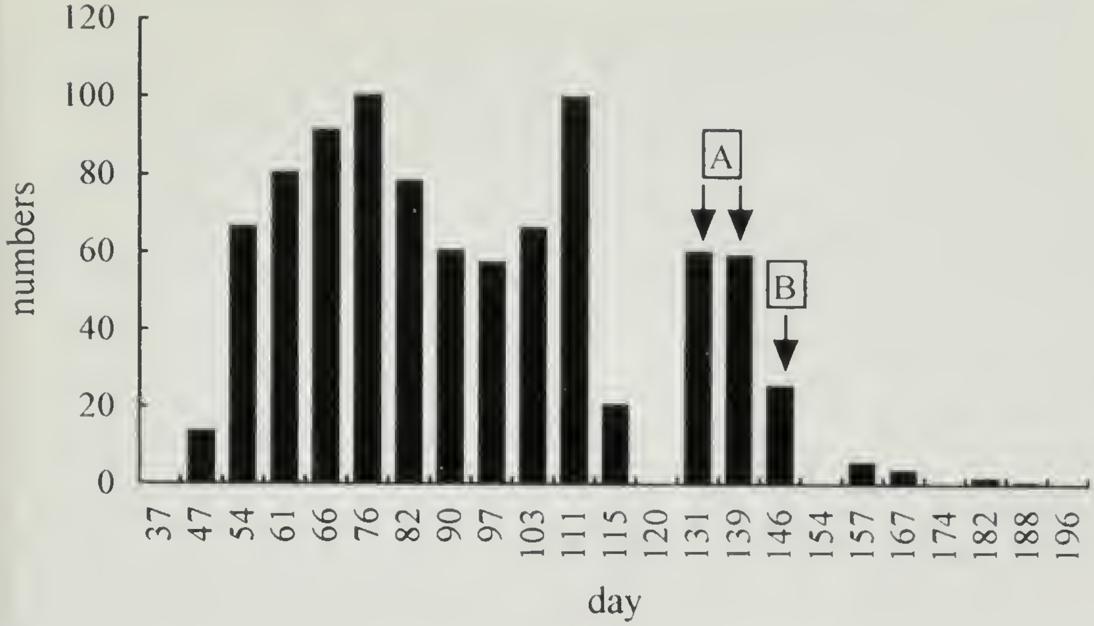

FIGURE 6
Number of bats counted on each survey day (26 March = day 0).
All counts before 24 July (day 120) were from the south-west roost.
A – counts from the under-arch roost; B – count from the north buttress roost.
Data from 27 August (day 154) onwards are rough estimates of numbers of feeding bats.

Breeding

Considerable fluctuations in numbers of bats counted out of the south-west roost occurred during the first half of the season, up to 15 July. The gradual climb to the first maximum on 10 June was probably caused by bats assembling at the breeding roost over a period of time. The subsequent decline to a low of *c*.60 might be a result of bats staying in to give birth/suckle and/or of some bats moving to alternative roost sites in the bridge or elsewhere. Numbers then rose to a second peak of 101 on 15 July, the agreement in peak numbers is almost certainly a coincidence. All had left the south-west roost before 24 July indicating that, by then, all juveniles were flying. Extrapolating back from the second peak, and assuming young fly at about three weeks of age (Schober & Grimmberger, 1989), puts birth at around the last week in June. This is consistent with Schober & Grimmberger's (1989) statement that birth is from the second half of June and into July. During 1995, bats were netted on two occasions. On 31 May all four bats caught outside the south-eastern roost were adult females, while of three caught from the under-arch roost on 4 August, two were juvenile females, the third a juvenile male. Many of the bats seen emerging from the north-west-facing buttress on 19 August were obviously juveniles. Bats had been netted from the south-eastern roost on two previous occasions; five adult females on 14 June, 1992 and two adult females on 12 May, 1993 (Table 2). Thus the sample of adult females netted on 31 May is consistent with previous observations of roost composition before juveniles fly.

Temporal trends in bat numbers

The south-eastern roost of Daubenton's bats at Kexby Bridge was discovered in 1983 and since then counts have been made by different observers, at different times during the season, on a number of occasions (Table 2). Numbers are difficult to compare over years but, despite yearly fluctuations, the overall impression is that the adult female population size (i.e. bats counted during June) shows no long-term trends. Highest counts are 52

(1985; 1 count in June), 106 (1986; 2 counts), 132 (1990; 2 counts), 93 (1991; 2 counts), 73 (1992; 2 counts), 93 (1993, 3 counts), 89 (1994, 3 counts) and 90 (1995, 3 counts) (Tables 1 and 2). However, in years where more than one census was made during June, counts decreased over time in four years, increased in two and remained essentially static in one (1986). These temporal changes in apparent bat numbers suggest that counts during a fixed period, as an index of population size, should be treated with great caution.

Emergence delays can also be calculated for the Kexby roost for years prior to 1995 (Table 2). There are no significant differences between years (one way ANOVAR, n.s.) and combining data yields a mean emergence delay of 23.5 minutes (range 12-42 minutes; 95% confidence interval of mean, 18-29 minutes), very close to the figure for 1995.

TABEL 2
Counts of Daubenton's bats at Kexby Bridge, 1983-1994.

Year	Date	Count	Recorder[1]	Notes
1983	?	90	S.W.[2]	
1984	?	>40	S.W. & R.S.(?)[3]	
1985	26 May	49	L.H.	1 returned during count
	3 June	52	L.H.	
	2 August	111	L.H.	Emergence interval: 21.23-22.14hr
1986	19 May	56	L.H.	1 returned during count
	13 June	106	L.H.	Emergence interval: 20.00-20.33hr
	20 June	100	L.H.	Very cold night
	1 July	111	L.H.	Emergence interval: 21.55-22.31hr
	6 July	117	L.H.	
1990	2 June	132	EYBG	Temp. 11°C
	22 June	81	G. & R.O.	
1991	9 June	74	EYBG	Emergence interval: 21.53-22.44hr; Temp. 11°C
	22 June	93	G. & R.O.	Emergence interval: 22.02-22.38hr
1992	14 June	24	EYBG	Temp. 18°C, 5 x female adults netted
	20 June	73	G. & R.O.	Emergence interval: 21.56-22.40hr (when bats started to return)
1993	12 May	10	EYBG	Temp. 9°C, 2 x female adults netted
	5 June	93	G. & R.O.	Emergence interval: 21.53-22.30hr
	13 June	87	G. & R.O.	Emergence interval: 21.59-22.41hr
	26 June	75	G. & R.O.	Emergence interval: 22.04-22.30hr (1 bat returned between 22.10 and 22.15hr)
1994	11 June	89	G. & R.O.	Emergence interval: 22.13-22.45hr
	17 June	67	G. & R.O.	Emergence interval: 21.50-22.35hr
	27 June	65	G. & R.O.	Emergence interval: 22.02-22.35hr

[1] EYBG, East Yorkshire Bat Group; L.H., L. Helliwell; G. & R.O., G. S. & R. H. Oxford; R.S., R. E. Stebbings; S.W., S. Walsh.

[2] Cited in Thompson (1985).

[3] Lesley Helliwell, *pers. comm.*

Discussion

Daubenton's bat is a relatively widespread species in Yorkshire (e.g. Whiteley & Johnson, 1984; Clarkson & Whiteley, 1985; Thompson, 1985; Roberts, 1988). The present

study represents the first detailed investigation of this species in the county over an entire breeding season. Elsewhere in Britain, similar work has been carried out by Swift and Racey (1983) near Newtonmore, Inverness-shire, and by Richardson (summarised 1985) in Northamptonshire.

In 1995, bats at Kexby emerged on average 26 minutes after sunset, a figure highly consistent with data from the same colony in previous years. This mean emergence delay (for 1995) is significantly ($P<0.05$) smaller than the figure of 45 minutes (range 11-77 minutes, 86 observations) quoted by Richardson (1985), and highly significantly smaller ($P<<0.001$) than the figure for Newtonmore of 105 minutes (range 89-147 minutes, 15 observations). In the Sheffield area, most records refer to bats emerging 15-20 minutes after "dusk" (Clarkson & Whiteley, 1985). There is apparently no simple latitudinal relationship between sunset time and emergence delay in this species. However, the Scottish study is complicated by the fact that the Daubenton's bats were sharing a roost with brown long-eared bats (*Plecotus auritus* (L.)), which left on average 40 minutes after sunset. Swift and Racey (1983) suggest that interspecific interactions may have resulted in this temporal partitioning as both species were using the same access hole. These comparisons suggest that emergence delay varies very little for a specific roost, not only within a season but also between years. It appears, therefore, to be a constant, colony-specific characteristic which varies between different roosts of the same species. The reason(s) for emergence delay differences between single-species colonies are not clear.

The only environmental factor measured that had a significant effect on the variability in emergence time was wind speed. If the relationship is real, presumably the first bats preparing to emerge at dusk "sense" blustery conditions at the roost entrance and delay their departure accordingly. Whether this knowledge is obtained directly or indirectly (e.g. via local temperature effects) is unknown. Swift (1980), in her study of activity patterns in Pipistrelle bats (*Pipistrellus pipistrellus* (Schreber)) in north-east Scotland, also found a very close relationship between emergence time and sunset but was unable to account for day-to-day variation in emergence delay by changes in cloud cover, wind speed, ambient temperature, rain, light mist or moonlight.

The numbers of bats counted varied through the summer, although the discovery of two previously unknown roost site in the bridge means that reliable estimates were difficult later in the season. A number of observations suggest that there is considerable mobility between roosts within the bridge and/or elsewhere. It is assumed that the initial increase to 101 individuals on 10 June represents the gathering of breeding females. Certainly all 11 bats netted over the years during this period in the season have been females. Numbers then dropped to a low of *c.*60 in late June/early July. If this drop was a result of heavily pregnant or nursing bats remaining within the roost, and if, as a conservative estimate, only half the females successfully gave birth to a single young, then, by the time juveniles were on the wing, counts of *c.*150 would have been expected. The second peak on 15 July only reached 101. This suggests that the drop from the first peak was a result of adult females leaving the roost and moving elsewhere. If these too were breeding females, clearly only a portion of the reproductive output of the whole population was monitored.

The south-western roost was abandoned at a time when the weather was very sunny and temperatures high (24°C at *c.*21.00 hrs. on 19 August). This roost site receives the full glare of the sun for the majority of the day. Bats presumably moved to seek cooler conditions, and it is probably not coincidental that the two new roosts were either under the bridge or on the north-facing side. For this reason, it seems unlikely that bats moving from the south-western roost during late June/early July would have utilised these alternative sites within the bridge if they were about to produce young. A second apparent drop in population size was found when the 101 individuals abandoned the south-western roost. Only 60 individuals were subsequently counted from the under-arch site although some may have moved to the (then unrecognised) buttress roost. Of the small number of bats netted from the under-arch roost all were juveniles and it is possible that, by this time, a proportion of the adult females had left the bridge (see Swift (1980) for a similar pattern in Pipistrelles). Future, simultaneous counts from all roosts will address at least some of these considerations.

Overall, there are no strong indications that the counted population size of the Kexby roost has changed substantially over a 12 year period. The apparent stability of this colony, against the general background of dwindling bat numbers (Stebbings & Griffith, 1983), may reflect the continuing high water quality of the River Derwent, over which the bats forage. An alternative possibility is that the stability in bat population size is an illusion. The size of the favoured south-western roost may impose a physical limit on the number of bats it can accommodate, forcing some individuals to breed elsewhere. If the bridge offers the preferred nursery site then, as long as numbers of bats are greater than the roost limit, counts from this roost will be stable, although the overall population size may be declining. This is another factor that might limit the usefulness of "snap-shot" counts.

ACKNOWLEDGEMENTS

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BATS AND THEIR ROOSTS IN CLEVELAND AND NORTH EAST YORKSHIRE IV: SEXUAL DIMORPHISM IN SIZE OF THE PIPISTRELLE BAT

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ABSTRACT
Forearm lengths for 55 adult pipistrelle bats (*Pipistrellus pipistrellus* Schreber) from north-east England are provided, males being 3.82% smaller than females. How this relates to existing data on the pipistrelle in Britain is discussed and the reasons for this dimorphism are considered.

INTRODUCTION

The existence of sexual dimorphism in the size of vespertilionid bats is well known, females being slightly larger than males, probably due to the need for the former to fly with and nourish proportionately very large foetuses (Myers, 1978). Data on species occurring in Britain are provided by Corbet and Harris (1991), with Stebbings (1991) making the general comment that males are on average 6% smaller than females.

Body mass among vespertilionid bats is often very variable, largely due to marked seasonal patterns of activity with respect to reproduction and hibernation. Furthermore, mass of the pipistrelle *(Pipistrellus pipistrellus* Schreber) can vary by a factor of 0.3 in 24 hours (Stebbings, 1973). Consequently, linear measurements, notably that of the forearm (i.e. radius length) are of much greater value in the investigation of size variation. Nevertheless, for the pipistrelle, Britain's most common bat species, most published data on forearm length refer to females, the reason being that adult males roost either singly or in very small groups, making them difficult to locate for study. In contrast, females form large, quite conspicuous nursery colonies during spring and summer, often of 100 or more animals.

The earliest published data on sexual dimorphism in forearm length of the pipistrelle appears to be that of Barrett-Hamilton (1911), relating to twelve males and eleven females. Stebbings (1968) and Walton (1975) provided data on juvenile but probably fully grown pipistrelles of both sexes from single colonies in Dorset and near Aberystwyth respectively. Mean forearm lengths for ten groups of female pipistrelles from various parts of the British Isles, and just one group of 97 males from Northamptonshire, are provided by Avery (1991). In addition, Stebbings (1973) carried out a large-scale investigation into the possible existence of size clines in forearm length of female pipistrelles in Britain.

The purpose of this article is to present and discuss data on sexual dimorphism in forearm length of the pipistrelle from a defined area of north-east England.

METHODS

The study area (see Wardhaugh 1993, fig. 1) includes the former county of Cleveland and part of North Yorkshire (i.e. parts of Watsonian vice-counties 62 and 66). Forearm measurements for 55 pipistrelle bats were collected from 1985 to 1995 inclusive. Twenty-eight males were measured, all being either isolated individuals which had strayed into buildings, or else exhausted, injured or freshly dead animals. Of the 27 females involved, nine were similar in origin to the males, whilst 18 were caught at dusk as they emerged from roosts and were measured as an incidental part of other work (Wardhaugh, 1992, 1994). The latter group of animals originated from a total of nine roosts, distributed throughout the study area.

All forearm measurements, of the right radius, were made using Draper vernier calipers, employing the measuring technique described by Stebbings (1967). Measurements were

made to the nearest 0.1 mm. Limited trials involving repeat measurements of a sample of animals indicated that accuracy was to within ±0.1mm. All animals were fully grown adults, as evidenced by completed ossification of the epiphyses of the metacarpals and phalanges (Stebbings, 1986).

As required by the 1981 Wildlife and Countryside Act, this work was carried out by the author under licence issued by English Nature.

Results

Due to the lack of widely accessible data on forearm length of adult male pipistrelles, the measurements taken are provided in full in Table 1. The difference in mean forearm length between sexes is highly significant ($d = 5.99$; $p<0.001$), mean lengths of males being 3.82% less than that of females. Since females came from two sources, i.e. those found stranded, exhausted, injured or freshly dead (9 animals) or taken from maternity roosts (18 animals), these were compared statistically. Mean forearm lengths for these two groups were 32.59 ± 0.30mm and 33.16 ± 0.19 mm respectively, the difference not being significant ($t = 1.59$; p between 0.2 and 0.1). Means from the present study are compared with those from other investigations carried out elsewhere in Britain (Table 2). Coefficients of variation (i.e. S.D. x 100/mean) were calculated for the present work and for two other studies by Stebbings (1968) and Walton (1975) where sufficient data were provided for comparative purposes (Table 3).

TABLE 1

Forearm length of the pipistrelle *(Pipistrellus pipistrellus)* in north-east England (n = 55)

Forearm Length (mm)	Number of animals males	females	Forearm length (mm)	Number of animals males	females
30.0	1	–	32.3	–	1
30.1	–	–	32.4	–	2
30.2	–	–	32.5	1	–
30.3	–	–	32.6	1	2
30.4	–	–	32.7	1	1
30.5	–	–	32.8	–	–
30.6	1	–	32.9	–	–
30.7	–	–	33.0	–	2
30.8	–	–	33.1	–	1
30.9	2	–	33.2	–	–
31.0	1	–	33.3	1	1
31.1	–	–	33.4	–	–
31.2	–	–	33.5	–	2
31.3	1	–	33.6	–	1
31.4	2	–	33.7	–	1
31.5	3	2	33.8	–	1
31.6	2	1	33.9	–	3
31.7	1	–	34.0	–	2
31.8	1	–	34.1	–	–
31.9	3	1	34.2	–	–
32.0	4	2	34.3	–	–
32.1	1	–	34.4	–	1
32.2	1	–	Mean ± S.E.	31.71 ± 0.127	32.97 ± 0.168

TABLE 2

Forearm length of the pipistrelle *(Pipistrellus pipistrellus)* from various parts of Britain

Author & Location		Mean forearm length (mm) males (n)	females (n)	Comments
Stebbings (1968) Dorset	adults	– (–)	31.51 (40)	Animals all from one roost 30.7.67 to 10.8.67. Mean difference between juvenile males and females highly significant. p<0.001
	juveniles	30.89 (204)	31.79 (185)	
Stebbings (1973) Co. Durham	adults	– (–)	32.7 (121)	Animals evidently from a nursery roost.
Walton (1975) Aberystwyth	adults	– (–)	– (–)	All animals from one nursery roost. 17.8.69. Mean difference between juvenile males and females highly significant. p<0.001
	juveniles	29.92 (25)	30.87 (30)	
Avery (1991) Northamptonshire	adults	31.2 (97)	32.0 (179)	No information on the origin of the animals (e.g. nursery roost) is provided.
nine other areas in Britain	adults	– (–)	31.0–32.9 (18–412)	
Present study north-east Yorkshire & Co. Durham	adults	31.71 (28)	32.97 (27)	

In the above, juveniles are defined as animals deemed to be fully grown, being between about 60 days and one year in age.

Discussion

When considering the data in Table 2, it should be borne in mind that measurements for the present work were gathered over a period of ten years, animals of both sexes originating from a variety of localities. This should serve to avoid any bias due to size variation between years and between populations from different colonies. Such variation may have influenced the results in studies where all animals were obtained from one roost site at one time. Thus, for example, in an investigation of a nursery colony in Dorset (Table 2), Stebbings (1968) speculated that the larger size of fully grown juvenile females compared with that of adults may have been due to favourable weather during the summer of the year concerned which permitted the mothers of the former to feed well during lactation and thereby produce larger than average young. This in turn suggests that the juvenile males from this colony may also have been relatively large for Dorset pipistrelles (Table 2). In spite of this, their mean forearm length was 0.82mm less than that for adult males in the present study. Furthermore, both females and males from Cleveland and North Yorkshire were, on average, larger than animals from any other region (Table 2), among the closest in size being a group of adult females from County Durham (Stebbings, 1973). This is in accordance with a possible cline noted by Stebbings (1973) of increasing size from south to

north in Britain. Interestingly, Avery (1991) commented that "size varies regionally but with no obvious trends". The largest group of females listed in the latter publication was from Lincolnshire, with a mean forearm length of 32.9mm (n = 75), very similar to the mean of 32.97mm for the present study (Table 2).

TABLE 3

Coefficients of variation of forearm length for populations of the pipistrelle *(Pipistrellus pipistrellus)*

Author & location	Coefficient of variation %	
Stebbings (1968)	juvenile males	1.61
Dorset	juvenile females	1.62
	adult females	0.82
Walton (1975)	juvenile males	3.41
Aberystwyth	juvenile females	3.12
Present study	adult males	2.13
North-east Yorkshire & Co. Durham	adult females	2.64

The coefficients of variation noted in the present work of 2.13% for males and 2.64% for females are low, as is typical for bats when compared with those for the limbs of other mammals (Long, 1968). This probably results from constraints imposed by flight on proportional variation in bats. Moreover, they are suggestive of stabilising selection, whereby extremes in size tend to be removed from the population. In this respect, such data as are available are somewhat equivocal (Table 3). These figures are suggestive of regional differences and therefore comparison between them would be inappropriate. However, coefficients of variation calculated for the data collected by Stebbings (1968) may indicate stabilising selection, adult females having a markedly lower value than juveniles (0.82% compared with 1.62%).

Regarding size dimorphism, the mean difference noted in the present work of 1.26mm, with males 3.82% smaller than females, is greater than that in the only other set of data, involving adult males, from Northamptonshire (Avery, 1991), where the size difference was 0.8mm (2.5%). In the two studies involving juveniles by Stebbings (1968) and Walton (1975), the corresponding figures were 1.08 mm (2.83%) for the Dorset colony and 0.95mm (3.08%) for that in Aberystwyth. The reason for this slight but consistent size dimorphism in vespertilionid bats was investigated by Myers (1978) who rejected both sexual selection and resource partitioning with respect to diet as possible explanations. Regarding the latter, this is supported by the findings of Swift *et al.* (1985) who found no difference in diet between sexes in the pipistrelle. Myers (1978) provided evidence in support of the hypothesis that larger size in females is a consequence of the need to fly and provide nourishment for foetuses of unusually large size, commonly up to 30% of adult body mass at birth. Furthermore, it was both reasoned and then demonstrated among 28 species, chiefly from the Americas, that sexual dimorphism in forearm length is greatest in those bats which bear the most foetal and neonatal mass. Thus the modal number of young born per pregnancy per species was found to be positively correlated with the degree of sexual dimorphism in wing size. For the pipistrelle in England, the modal number of young is considered to be one and the degree of dimorphism noted in Northamptonshire was 0.8mm Avery (1991), the latter falling within the range of 0.04 mm to 1.02mm reported by Myers (1978) for species normally bearing single young. Interestingly, the degree of dimorphism noted in the present work (1.26mm) lies above this range and within that for

species usually bearing twins in Myers' study (0.86 to 1.53mm). The pattern among British bats may not be the the same as that in America, but regional variation in forearm length dimorphism which is correlated with variation in modal litter size has been demonstrated previously in *Eptesicus fuscus*, a North American species (Myers, 1978). Unfortunately, no data exist on litter size in pipistrelles in north-east Yorkshire.

In addition, Myers (1978) demonstrated that for several species of vespertilionid bat, males have proportionately smaller wings than females, even after size dimorphism is taken into account. It is possible that this makes flight during adverse conditions more hazardous for males: this may explain why, in the present study, it was noted that there was a highly significant preponderance of males among isolated pipistrelles found exhausted, injured or freshly dead (Wardhaugh, 1993).

Unfortunately, most of the present work was carried out prior to the discovery that the pipistrelle consists of two distinct, sympatric forms (Jones & van Parijs, 1993), the principal difference between these being the frequency bands of their echolocation calls, the frequencies containing the most energy averaging 46 kHz and 55 kHz for the two phonic types. Measurement of 48 females from seven roosts revealed a slight but statistically just significant difference in mean forearm length (32.37 ± 0.59mm for the "low frequency" type and 31.91 ± 0.82mm for the "high frequency" type; $t = 2.26$, $p<0.05$). However, there was considerable overlap in forearm length, and a discriminant function analysis indicated that there was no significant difference between the two phonic types in overall flight morphology (Jones & van Parijs, 1993). Nevertheless, molecular data, differences in social calls, differences in skull morphology and assortive association in mating sites all suggest that these two forms of the pipistrelle are cryptic species (G. Jones, University of Bristol, *pers. comm.*). Unfortunately the phonic type of the males involved in the present study is not known and clearly it is now evident that there remains much scope for further work in this field.

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BOOK REVIEW

The Current Status of the Brown Hare *(Lepus europaeus)* in Britain by **M. R. Hutchings and S. Harris**. Pp. 78. Joint Nature Conservation Committee, Peterborough. 1996. £12.50.

Since this is an important review of its subject, it is therefore all the more disappointing that it may be doubly inaccessible to most of its potential readership.

Professor Harris was asked to organise a national survey of the status of hares in Britain, and 751 one-kilometre squares were walked by volunteer surveyors. The sample of squares was a stratified one, selected by land-class to represent on proportion all the major habitat groups in Britain, and surveyors walked a 3-kilometre transect within the periphery of each square three times during the winter months. In total, 1325 Brown Hares were seen (but the few Mountain Hares were too clumped for their distribution to be analysed, and they are not mentioned in this report). Because of the way the sample was stratified and the distance from the transect to each hare seen was recorded, this information can be used to estimate the density in each habitat and the numbers overall; there were believed to be 817,520 ± 137,251 in mid-January 1993/1994.

So why is this report likely to be doubly unavailable? Most of the report is taken up with a detailed analysis of the methods involved in obtaining these estimates and in verifying their use. This is important but makes for hard reading; it is the analysis of technical statisticians rather than biologists. Conversely, those results which would interest a biologist are presented very curtly. One would have liked a map of the likely density and distribution of hares, but the only maps are of the 7 land-classes. A map of the survey squares would also have been of interest. So, for many biologists, this report is likely to be inaccessible because of the intensity of the technical writing. It is also likely to be inaccessible for its price: at £12.50 for 78 pages, it is hard to claim that it is good value. The recent report on the status of all the British mammals, from the same publisher, cost £16.50 for 168 pages.

It would be a pity if it is ignored for the report contains a useful summary of the historical and ecological factors affecting hare numbers, as well as much useful information, for those that want it, on the strengths and problems of analysing transect data. At least encourage your library or society to get a copy.

DWY

THE EXTINCT "WILD" CATTLE OF BURTON CONSTABLE HALL, EAST YORKSHIRE

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Introduction

The herds of "wild" white cattle inhabiting, or known once to have inhabited, the enclosed parks associated with various country houses in Britain have excited much interest amongst both naturalists and historians, for over two hundred years. Debate as to whether these cattle were genuine wild bovids, descended directly from the aurochs (*Bos primigenius* Bojanus) without an intervening stage of domestication, or merely the descendants of feral domestic cattle, of medieval or even earlier date, was particularly vigorous during the 19th century (e.g. Harting, 1880). They are now, however, generally thought to have been derived from locally-selected husbanded cattle (Corbet & Harris, 1991), although the dates of origin of even the best-known herds are often obscure (Whitehead, 1953; Bilton, 1957). Although only five herds of these "wild" white cattle – those from Cadzow (Strathclyde), Chartley (Staffordshire), Chillingham (Northumberland), Dynevor (Dyfed) and Vaynol (Gwynedd) – have representatives surviving to the present day, the previous existence of several further herds is well documented (Whitehead, 1953). One of the least well-known of these extinct herds is that which, for an unknown period prior to the mid-18th century, occupied the park at Burton Constable Hall in East Yorkshire. While the present paper does include a brief review of previously published references to the Burton Constable herd of "wild" white cattle, its main purpose is the publication of an informative but hitherto unpublished manuscript account of this herd, written in 1783 or 1784 by Marmaduke Tunstall (1743-1790) of Wycliffe Hall in County Durham. In view of the very sparse nature of the published information hitherto available with respect to the Burton Constable "wild" cattle, Tunstall's description of the herd and its management is, although brief, of some importance.

Historical Review

The earliest published reference to the existence of a herd of "wild" white cattle at Burton Constable Hall appeared in the first edition of Thomas Bewick's *General History of Quadrupeds* (Bewick, 1790) and was repeated in subsequent editions of that work. To his lengthy account of the appearance and behaviour of the famous Chillingham herd of "wild" white cattle, Bewick appended a short paragraph on the Burton Constable herd. This paragraph is, for reasons which will become apparent below, worth quoting in its entirety:

> "Those at Burton-Constable, in the county of York, were all destroyed by a distemper a few years since. They varied slightly from those at Chillingham, having black ears and muzzles, and the tips of their tails of the same colour: they were also much larger, many of them weighing sixty stones; probably owing to the richness of the pasturage in Holderness, but generally attributed to the difference of kind between those with black and with red ears, the former of which they studiously endeavoured to preserve".

In the second volume of his *History and Antiquities of . . . Holderness*, the historian George Poulson presented what appear, at first sight, to be detailed accounts of both the appearance and the behaviour of the Burton Constable "wild" cattle (Poulson 1841, p. 241). Close inspection of his published text, however, reveals that most of the information given by Poulson, including all that relating to the behaviour of the animals, represents no more than a paraphrase of Bewick's (1790) account of the morphology and habits of the Chillingham "wild" cattle. Poulson, who quoted Smith (1827) as his authority for regarding all British "wild" white cattle as genuine wild representatives of the aurochs, seems to have considered that the implied conspecific status of the Chillingham cattle and those once

present at Burton Constable was sufficient to justify attributing the recorded habits of the former herd to the (extinct and poorly known) latter. The only factual data given by Poulson (1841) with respect to the Burton Constable "wild" cattle – that they "differed from the others in having the ears and tips of the tail black" and that the herd was "destroyed in the middle of the last century, by a distemper" – are no more than might easily have been gleaned from Bewick's (1790) paragraph relating to the animals in question.

The Rev. John Storer, whose book on *The Wild White Cattle of Great Britain* appeared in 1877, was also unable to add anything of significance to the data presented by Bewick (1790) on the Burton Constable herd, although he did make the interesting if hardly warranted suggestion that the herd in question had been composed of polled, rather than horned, individuals. Storer (1877) also speculated that the ancestors of the "wild" cattle once comprising the Burton Constable herd might originally have been brought from the very estate at Wycliffe which had been the home of Marmaduke Tunstall.

Although Harting's (1880) work on extinct British mammals included a lengthy account of the various recorded herds of "wild" white cattle, his description of the Burton Constable herd consisted, as he acknowledged, of little more than a direct quotation of Bewick's (1790) account. With respect to the original source of the Burton Constable "wild" cattle, Harting was more cautious than Storer (1877) had been and, whilst making due reference to the latter's suggestion, pointed out that "the origin of this herd has only been surmised".

The previous existence of a herd of "wild" white cattle at Burton Constable was noted by Clarke and Roebuck (1881, p. 12) in their useful summary of the Yorkshire vertebrate fauna as then known. However, these authors gave no information about the herd beyond describing it as having existed "in a state of semi-domestication" and as having "perished of distemper" shortly before the close of the previous century.

The only really substantial work upon British "wild" white cattle to have been published during the present century is Whitehead's (1953) *The Ancient White Cattle of Britain* and this, as might be expected, does include a brief account of the Burton Constable herd. Whitehead suggests a date of about 1780 for the extinction of the "wild" cattle at Burton Constable and, after describing Bewick's (1790) account of this herd as "about the only first-hand description" available, repeats it *verbatim*. Whitehead (1953, pp. 110; 150) also notes Storer's (1877) suggestion that the ancestors of the Burton Constable "wild" cattle came originally from Wycliffe Hall, in County Durham, but does not comment upon this theory. With respect to Storer's second suggestion regarding the Burton Constable herd – that it was composed of polled cattle – Whitehead (1953, p. 154) seems rather more critical, and lists the herd in question as one "believed to be horned". Interestingly, this last supposition receives support from a painting of Burton Constable Hall (Anglo-Dutch School, *c.* 1690) currently hanging in the Entrance Hall of that building. Recent inspection of this painting by the author has revealed the presence of a group of thirteen white cattle represented in the park to the south-west of the Hall itself. The cattle are depicted at too small a scale to yield any information with respect to the colouration of their ears, muzzles and tails, but it is noteworthy that some, at least, bear clearly-defined horns (Figs 1 and 2).

As will be apparent from the above review of published references to the Burton Constable "wild" white cattle, the brief description given by Bewick (1790) is not only the earliest published account of these animals but – inasmuch as later authors merely quote or otherwise repeat his account – is also effectively the only published description of the herd hitherto available. While this fact serves further to emphasise the importance of Marmaduke Tunstall's manuscript account, which is reproduced below, it also raises the question of how, precisely, Bewick obtained the data he published regarding the Burton Constable cattle. Fortunately, Tunstall's description of the herd also sheds light upon this question, at least insofar as it makes it possible to determine whether or not Bewick's (1790) account was, as Whitehead (1953) suggests, a "first-hand description".

Marmaduke Tunstall's Account

Marmaduke Tunstall's manuscript description of the Burton Constable "wild" white cattle forms part of a letter written by him to the Reverend William Dade, Rector of Barmston, when the latter was collecting information for an intended "History" of Holderness. Dade did not complete this task, but the manuscript notes he assembled for the purpose – which include the letter from Tunstall noted above – now constitute part of the Burton Constable Archive deposited at the Humberside County Record Office in Beverley (HCRO File DDCC 112/157). Tunstall's letter to Dade bears no date, but the form of the handstamped transit-mark for Wetherby on its outer surface, in which the last two letters of the town's name are situated centrally beneath the first six, is sufficient to establish that the letter was committed to the mail in either 1783 or 1784 (J. M. Boyd, *pers. comm.*). The greater part of Tunstall's letter concerns other aspects of the history and natural history of Holderness, but the section dealing with the Burton Constable "wild" cattle reads as follows:

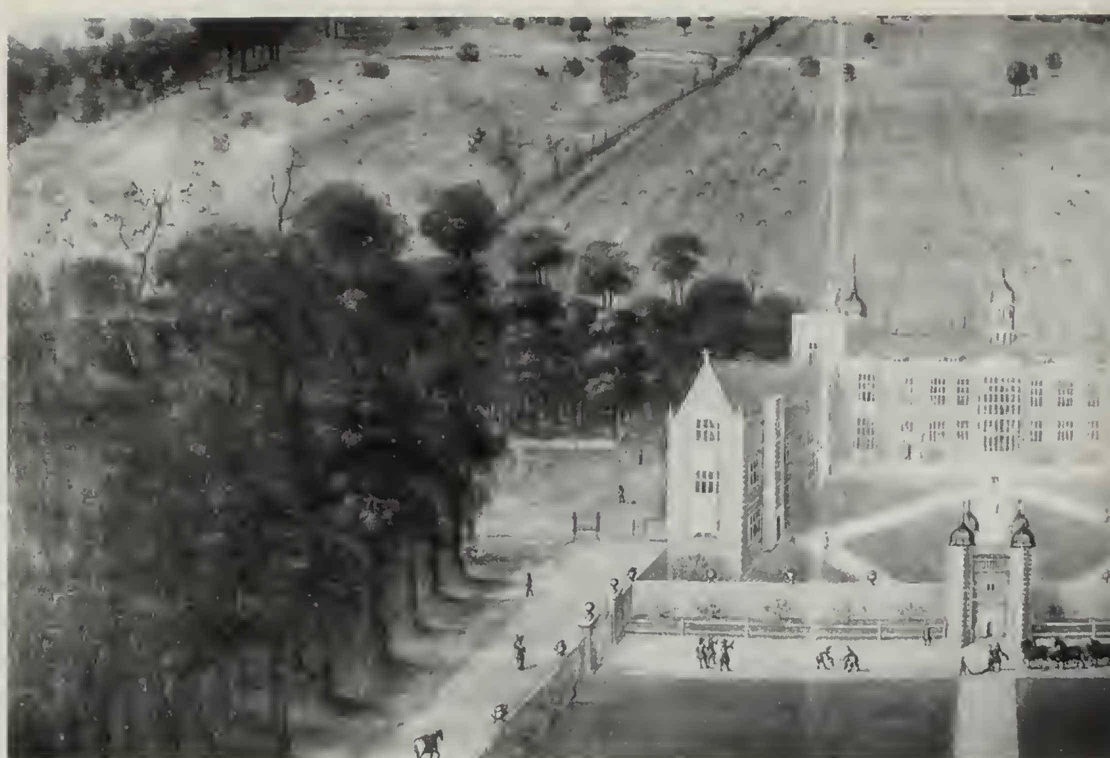
> "Perhaps the Wild Cattle late in Burton Park, which I can remember when a Child, tho' only a *naturalised* species, might deserve mention, as they had probably been there for some ages, they were totally white, except their muzzles & ears, which were black, they were not under the jurisdiction of Man & were shot when fit for slaughter; the Bull was usually so savage as made it necessary to putt out his eyes; believe this was the only place except Chillingham in Northumberld, now Ld Tankerville's, where they were found in South-Britain; my father indeed gave some to the D: of Norfolk at Worksop, as also to Mr Aislaby at Studley, but am told the breed at both places is now extinct or at least not preserved genuine; they were esteemed highly for their capital flavor; those at Burton were totally destroyed by the distemper, I think about the year 1746 or 47; they were supposed to be descended from the *Bisontes jubati* of the *Caledonian* forest mentioned by Hector Boethius & afterwards by Sr Robt. Sibbald, but as well as those at the D: of Hamilton's & the few that still are in some parts of N: Britain, had long lost their shaggy manes".

With respect to the above passage, it should be noted that the Hector Boece (or Boethius) referred to by Tunstall published, in 1527, a "history" of Scotland entitled *Scotorum Historiae, a prima Gentis Origine*. In this work, he made reference to wild white bulls "with crisp and curling manes like fierce lions" inhabiting the remnants of the great Caledonian Forest. These animals, according to Boece, were so wild that they would not even feed upon vegetation that bore the scent of human beings. Sir Robert Sibbald, writing over a century later, in his *Scotia Illustrata* of 1684, seems to have doubted the accuracy of Boece's description of the cattle concerned, but the question of their status with respect to the "wild" white cattle comprising the enclosed herds known from Great Britain was nonetheless to become a recurrent subject of debate during the 19th century (e.g. Harting 1880, pp. 222-223).

Discussion

In addition to possessing considerable intrinsic interest, the information contained in Tunstall's account of the "wild" white cattle of Burton Constable allows the correction of three erroneous suppositions which have, over the years, made appearances in the published descriptions of this poorly-known herd:

1. The date of extinction of the Burton Constable herd was not, as almost all authors who have discussed these cattle have either stated or implied, late in the 18th century. As is now apparent, the herd had died out by about 1747. The various published statements to the effect that the Burton Constable "wild" cattle became extinct "shortly before the close" of the 18th century (Clarke & Roebuck, 1881) or "about 1780" (Whitehead, 1953) seem to represent no more than estimates, based solely upon the fact that Bewick, writing in 1790, described the herd as having died out "a few years since".
2. Since the Burton Constable "wild" cattle are now known to have become extinct by about 1747, the account of the herd given by Bewick, who was not born until 1753, can



no longer be regarded as the "first-hand description" that Whitehead (1953) suggests it represents. Ironically, it seems very likely that Bewick's (1790) account of the cattle in question – the account from which all subsequent authors appear to have drawn their data – was actually based upon information supplied by Tunstall, who, the half-brother of William Constable (1721-1791) of Burton Constable Hall, was not only a very competent gentleman-naturalist (Fox, 1827; Goddard, 1929) but is known to have had an especial interest in the various British herds of "wild" white cattle. It was he who, in 1788, commissioned Bewick to produce his famous woodcut of the "Chillingham Bull" (Goddard, 1929, p. 18), and it is clear from a letter that Tunstall wrote to Bewick in 1789 (Fox, 1827, p. 24) that the former had, for some years, actively been collecting information for an intended publication on British "wild" cattle, which he also passed on to Bewick for the latter's own use.

3. There appears to be no evidence whatever to support the suggestion made by Storer (1877) that the ancestors of the Burton Constable "wild" cattle may have been brought from the Wycliffe Hall estate in County Durham. This was the home of Marmaduke Tunstall who, in addition to being an enthusiastic naturalist, took a keen interest in the history of his family and its lands. If any real evidence had existed to indicate a Wycliffe origin for the Burton Constable herd, it seems almost inconceivable that Tunstall would have been unaware of it – or that he would have failed to communicate it to William Dade. The present author is, in addition, unaware of any evidence that a herd of "wild" cattle ever existed at Wycliffe.

With respect to the date – as opposed to place – of origin of the Burton Constable herd of "wild" white cattle, the only relevant data known to the present author are contained in two 18th century manuscripts now in the Bodleian Library in Oxford. These manuscripts (MS English Letters C.229, pp. 17-22) comprise a letter written to Marmaduke Tunstall by William Constable on 14th December 1787, and a second document – also in Constable's hand – which seems to have been intended as a more orderly summary of the data presented in the letter. These two documents, taken together, appear to represent Constable's response to his half-brother's request for further information regarding the Burton Constable "wild" cattle. In both documents, he notes the existence of a "tradition" that the cattle in question first arrived at Burton Constable "on the Accession of James 1st". Otherwise, apart from indicating that the herd was composed of no more than thirty individuals at the time of its extinction, Constable's manuscript accounts of the "wild" cattle of Burton Constable contain little of substance that had not earlier been summarised by Tunstall in the short account he prepared for Dade. Constable's notes do, however, provide useful confirmation of the accuracy of Tunstall's account of the appearance, temperament and management of the animals concerned.

It would seem appropriate to conclude with a brief note on the habitat once occupied by the Burton Constable herd of "wild" white cattle. The park at Burton Constable, which consisted of about 380 acres in 1578, apparently reduced to 290 acres by 1867, also housed varying, but often substantial, numbers of Red Deer and Fallow Deer until

FIGURE 1 (opposite)
Upper-left quarter of painting of Burton Constable Hall (*c.*1690) showing, in the top left-hand corner, a group of thirteen 'wild' white cattle present in the park to the south-west of the Hall itself. The entire painting measures 214 cm in length and is 160 cm in height. (Leeds Museums and Galleries: Burton Constable).

FIGURE 2 (opposite)
Detail from the area of painting comprising Figure 1, showing the thirteen 'wild' white cattle depicted in the park at Burton Constable, *c.* 1690. Most, if not all, of the cattle are represented as bearing well-defined horns. The largest animal present in the group measures 2 cm in length on the original painting.
(Leeds Museums and Galleries: Burton Constable).

around 1880 (Neave, 1991, p.26). The present appearance of the park is, to a large extent, the result of landscaping work carried out between 1769 and 1783 by "Capability" Brown. This land was, apparently, rather different in appearance prior to the commencement of Brown's "improvements" and was described by William Constable as being then a "wilderness . . . with swamps, gorse and whin higher than a man on horseback" (Hall, 1991, p.68). In such terrain, the stalking and shooting, with muzzle-loading guns, of large cattle so wild that it was considered necessary to blind the herd's sole or dominant bull must, on occasion, have been an "interesting" experience.

ACKNOWLEDGEMENTS

Thanks are due to Dr David Connell, Curator of Burton Constable, for his kindness in drawing my attention to the correspondence between Marmaduke Tunstall and William Dade, and for allowing me to publish the extract which forms the principal subject of this paper. I am also indebted to my father, for his assistance in dating Tunstall's letter to Dade, and to the respective staffs of the Bodleian Library in Oxford and the Humberside County Record Office at Beverley.

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EFFECT OF CROWN DENSITY ON CHOICE OF NESTING TREE BY MAGPIES *PICA PICA*

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INTRODUCTION

The Black-billed Magpie *Pica pica* usually nests in trees (Cramp and Perrins, 1994; Goodwin, 1986) using a wide range of species. In a study near Sheffield at least 21 species were used, with birds apparently showing a preference for either low thorny bushes or very tall trees (Birkhead, 1991). Coombs (1978) also lists a wide range of tree species used for nesting; he considered that the sites chosen varied with tree availability.

Nesting tree preferences by magpies have been studed by Tatner (1982a) in the Manchester area; they are particularly common in urban Manchester where numbers appear to have increased dramatically during the second half of this century, with densities of around six occupied nests per square kilometre at the time of Tatner's work in the late 1970s (Holland *et al.* 1984; Tatner, 1982b). Tatner (1982a) compared magpie distribution with various habitat characteristics, finding correlations with numbers and variety of available trees. He calculated a preference index for different tree species chosen by magpies for nest sites, and suggested that preferred species tended to have more closely knit canopies. This could not be tested statistically since no numerical data on canopy density were available. The aim of this paper is to describe such a test, using data on crown density from a general study of urban trees also carried out in Manchester (Wilkinson, 1991 & 1992; Wilkinson *et al.* 1991) and relate this to Tatner's tree preference index.

Ideally crown density measurements of the actual nest trees would be collected and compared with density values for the surrounding trees. Such data would be hard to collect since the measurement of crown density requires the tree to be photographed against a clear sky unobstructed by buildings or other trees. In the absence of such data the present study uses measurements of a general set of trees from the same city, collected for other purposes (Wilkinson, 1992).

METHODS

Tree choice by magpies

Tatner (1982a) recorded tree species containing magpie nests during breeding density surveys and stated that "To obtain an indication of nest site selection, the species of the ten trees nearest to the nest tree were also noted, except, when there were too few trees for this to be practical". A choice index was calculated as:

$$\text{Choice index} = \frac{\text{observed frequency of trees used}}{\text{expected frequency if trees chosen at random}}$$

Tree Crown Density

The crown density was measured as the percentage of light attenuated by the tree crown. This was measured phographically during 1990. A dot matrix was used to analyse a monochrome photograph of a tree crown by estimating the proportion of tree parts to sky within the area of the tree crown (Wager & Heisler, 1986; Wilkinson, 1991; Yates & McKennan, 1988). The photographs were taken with a 35-70mm zoom lens, to maximise the size of the tree's image, and at a camera elevation of approximately 25°. Three replicate sets of measurements were made for each photograph (Wilkinson, 1992). Sample sizes for each tree species ranged from 3 to 28 individuals. Photographs were taken for both summer and winter. As the main purpose of this study was to provide data to be used in modelling studies of light attenuation by urban trees, not all species which appear in

Tatner's data set were measured. However only two species commonly used for nesting by magpies in Tatner's study do not appear in the crown density data set, namely Manchester Poplar *Poplus nigra* and Jersey Elm *Ulmus whealeyi*. All the trees measured in the crown density data set were either parkland or street trees. Comparison between this photographic method and photometric ("light meter") methods shows consistency between the two approaches (Wilkinson, 1991; Yates & McKennan, 1988).

TABLE 1
Tree species selected as magpie nest sites in Manchester and crown density values for summer and winter. Light attenuation: mean (± s.d.; n).

	Choice Index from Tatner (1982a)	Winter light attenuation (%) (Wilkinson, 1992)	Summer light attenuation (%) (Wilkinson, 1992)
Lombardy Poplar *Populus nigra* 'Italica'	1.65	50.5 (0.1; 20)	87.2 (1.6; 20)
Alder *Alnus glutinosa*	1.40	50.5 (4.0; 5)	76.3 (5.5; 5)
Hawthorn *Crataegus monogyna*	1.03	55.9 (2; 6)	77.9 (1.6; 6)
Horse Chestnut *Aesculus hippocastaneum*	1.00	47.6 (2.6; 3)	81.3 (0.3; 3)
Beech *Fagus sylvatica*	0.55	53.1 (1.4; 6)	80.9 (2.5; 6)
Lime *Tilla x europea*	0.37	46.3 (1; 16)	88.7 (1.1; 16)
Ash *Fraxinus excelsior*	0.31	46.5 (2.6; 3)	77.9 (0; 1)
Oak *Quercus robur*	0.25	50.3 (0.9; 28)	82.5 (0.8; 28)
Sycamore *Acer pseudoplatanus*	0.25	46.3 (0.9; 28)	82.0 (1.1; 28)
Birch *Betula pendula*	0.17	46.0 (0.7; 23)	75.8 (1.4; 23)

Results and Discussion

There is a statistically significant correlation between choice index and winter attenuation ($r_s = 0.61$, $p<0.05$) but not between choice index and summer attenuation ($r_s = 0.09$. N.S.) (see Table 1).

These data support Tatner's (1982a) impression that the magpies were choosing trees with denser canopies, and were doing so at the time of nest building (usually March or early April), not on a prediction of density of the crown in leaf. Winter attentuation is not a good predictor of summer attenuation ($r_s = 0.08$, N.S.). At the time of starting nest building, Hawthorn is the only species which is likely to have started to come into leaf

(Wilkinson, 1992). It is of note that the highest choice index (CI = 2.35) in Tatner's study was for Holly, the only evergreen species in his study; unfortunately this species was not included in the photographic study of light attenuation, although as an evergreen it will be denser that any of the winter crowns in Table 1.

The shape of the tree canopy (e.g. Poplar *vs.* Sycamore) causes a potential problem in that wide tree crowns reduce the passage of light more than narrow crowns with the same density of branches per unit volume of crown. The methods used in this study only record the amount of light attenuated by the whole crown, but this probably corresponds quite closely to the bird's visual impression of crown density.

Why should magpies select trees with denser crowns? Tatner (1982a) suggested that a dense canopy "offers a thicket-like protection around the nest. Carrion Crows *Corvus corone* regularly visit magpie nests in Manchester and are known for their attempts to predate/usurp magpie nests". Casual observation by myself of magpies building nests in Hawthorn (dense crown) and Sycamore (less dense) suggests that the birds may find it easier to get the first twigs, which form the base of the nest, to lodge in a dense crown than in a sparsely branched one; conceivably both explanations could be correct. Other species with similar nesting behaviour, e.g. Carrion Crow and Buzzard *Buteo buteo*, may also select trees on crown density. The preference of Buzzards for conifers rather than deciduous hardwood trees (Cramp & Simmons, 1979) suggests this could be the case.

SUMMARY

A statistically significant positive correlation was found between the tree species preference previously demonstrated for nesting magpies and tree crown density in winter. It is suggested that thicker crowns offer some protection to the nest from predation and/or provide easier conditions for nest construction.

ACKNOWLEDGEMENTS

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BOTANICAL REPORT FOR 1995
FLOWERING PLANTS AND FERNS

Compiled by D. R. GRANT

The Recorders thank all those who have sent records: their names are given in full the first time they appear in the VC report, initials being used thereafter. Nomenclature is according to Kent, D. H. (1992) *List of Vascular Plants of the British Isles*.

EAST YORKSHIRE (VC61) (F. E. Crackles)

*denotes a 1st vice-county record.

Asplenium ruta-muraria L. Churchyard wall, Welwick 54/32, confirming an 1898 record; P. J. Cook.
Ranunculus arvensis L. Disturbed ground, North Duffield Carrs 44/63, 1994; T. E. Dixon.
Parietaria judaica L. Halsham church 54/22; P.J.C.
Atriplex glabriuscula Edmonston Spurn 54/41; F. E. Crackles & P.J.C.
A. littoralis L. In quantity, York Outer Ring Road 44/64, 1993; M. Hammond.
Montia fontana L. subsp. *fontana* Ditch bottom, Elstronwick 54/23; W. R. Dolling.
Stellaria pallida (Dumort.) Piré Base of dunes at Welwick Bushes and Winsetts Bank 54/31; P.J.C., conf. P. M. Benoit; also Spurn 54/41; P.J.C. confirming an earlier report by J. Dews.
Polygonum arenastrum Boreau Thixendale 44/86; P.J.C.
Hypericum perforatum x *H. maculatum* subsp. *obtusiusculum* = *H.* x *desetangsii* Lamotte Tophill Low 54/04; A. Marshall, conf. F.E.C.
**Lavatera arborea* L. Near the Humber bank near Paull Holme 54/12 and in two localities between Cherry Cob Sands and Stone Creek 54/22 and 54/21, 1991; P.J.C., conf. N. K. B. Robson.
Descurainia sophia (L.) Webb ex Prantl On imported soil, South Cave 44/93; R. Eades.
Cochlearia danica L. In great abundance on York Outer Ring Road 44/64, 1993; M.H. On grassy bank at east bound side of A1079; J.D.; also along side of the A1079 in 44/84, 93 & 94; P.J.C. Road verge, Burstwick 54/22; W.R.D. and Hedon Road, Marfleet 54/12; P.J.C.
Rubus echinatoides (Rogers) Dallman Roadside, west of Broomfleet 44/82; D. R. Grant.
Trifolium fragiferum L. In mown grass, near Haworth Hall, Hull 54/05; E. Chicken.
Scandix pecten-veneris L. Under wheat crop, near Swine 54/13; F. Kenington and in profusion in entrance to wheat field, Burton Pidsea 54/23. R. Middleton and under crop; P.J.C., the first records for Holderness since 1955 and the first for V.C.61 since 1970.
Veronica scutellata L. King's Mill Reserve, Driffield 54/05; E.C.
**Orobanche hederae* Duby In quantity as garden weed, Cottingham 54/03, apparently introduced with planted Ivy; M. Jordan, det. F.E.C.
**Valerianella locusta* (L.) Laterr. susbsp. *dunensis* (D. Allen) Sell Welwick Bushes 54/31; P.J.C., det. D. Allen. Previously only recorded for the west coast and Isle of Man.
Centaurea cyanus L. Disturbed ground, North Duffield Carrs 44/63, 1994; T.E.D. On allotments, North Cave 44/93; R.E.
**Taraxacun arenastrum* A. J. Richards Haverfield Quarries Reserve 54/32 and Welwick Bushes 54/31; P.J.C., det. A. Richards.
T. oxoniense Dahlst. Disused railway track, Ottringham 54/22; P.J.C., det. A. J. Richards.
Aster tripolium L. Borrow pit, Pulfin Bog 54/04, 1994; R.M., the northernmost record by the R. Hull, not previously recorded north of Dunswell 54/03. Roadside verge, South Cave 44/93; R.E.
Conyza cadansis (L.) Cronq. Westgate, Driffield 54/05; E.C.
Elodea nuttallii (Planchon) H. St. John Pond, near Burstwick 54/22; J.D.

Schoenoplectus lacustris (L.) Palla by pond, Tophill Low 54/04; A.M., det. F.E.C.
**Festuca rubra* L. subsp. *litoralis* (C. Meyer) Auq. Saltmarsh, Welwick 54/31 and several other locations along the Humber bank in 54/21 and 54/31; P.J.C., det. C. A. Stace.
Glyceria declinata Bréb. Muddy pond, Fimber 44/86; P.J.C.
Phalaris canariensis L. Scoroborough 54/04 and Wansford 54/05; E.C.
Allium oleraceum L. Huge colony, spread over 1km of river bank, Lower Derwent Valley National Nature Reserve 44/64; T.E.D.
A. scorodoprasum L. Flourishing colony, Lower Derwent Valley N.N.R. 44/64; T.E.D.

NORTH-EAST YORKSHIRE (VC62) (T. F. Medd)

Equisetum sylvaticum L. Yearsley Moor 44/57; D. R. Grant.
Ophioglossum vulgatum L. Garden weed, Scarborough 54/08; M. Robinson.
Hymenophyllum tunbrigense (L.) Smith Moss-covered rock, Eskdale 45/70; K. Trewren.
**Polypodium interjectum x vulgare = P. x mantoniae* Rothm. & U. Schneider Large colony in Carr Wood, Goathland 45/80; K.T.
P. interjectum Shivas Several colonies in East Arnecliff Wood 45/70; Sleights 45/80; Whitestone Cliff 44/58: Rosedale 44/79; K.T.
Phegopteris connectilis (Michaux) Watt Upper Farndale (8 colonies) 45/60; K.T.
Asplenium trichomanes-ramosum L. Flourishing colony, Upper Farndale 45/60; One plant near Hawnby 44/59; K.T.
Dyropteris aemula (Aiton) Kuntze East Arncliff Wood (4 colonies) 45/70; Falling Foss area 45/80; Cock Mill Wood, Ruswarp 45/90; K.T.
**D. carthusiana x dilatata = D. deweveri* (J. Jensen) Wachter Eston Hills (50 plants in 1994) 45/51; East Arncliff Wood 45/70; Goathland (new VC record in 1991) 45/80; Levisham 44/88; Hackness 44/98; K.T.
**D. dilatata x expansa = D. ambroseae* Fraser-Jenkins & Jermy Eskdale 45/70; K.T. det. Dr Mary Gibby.
Fumaria parviflora Lam. Hackness 44/99; M. Yates & K. Jones.
Humulus lupulus L. Thornton Bridge 44/47; D.R.G. and T.F.M.
Carpinus betulina L. Riccal Dale, Helmsley 44/68; D.R.G.
Myosoton aquaticum (L.) Moench Banks of R. Ouse, York 44/55; T.F.M.
Hypericum montanum L. Hackness 44/99; M.Y. & V.J.
Rubus fissus Lindley Harwood Dale 44/99; D.R.G. det. A. Newton.
R. scissus Watson Falling Foss area 45/80; YNU Excn. det. D.R.G.
R. nemoralis P. J. Mueller Yearsley Moor 44/57; Grimston Moor 44/67; Thornton-le-Dale 44/88; D.R.G. Newton Dale 44/89; YNU Bot. Sec. Excn. det. D.R.G.
R. newbouldii Bab. Yearsley Moor 44/57; D.R.G.
R. echinatus Lindley Castle Howard 44/67; D.R.G.
R. pallidus Weihe Falling Foss area 45/80; YNU Excn. det. D.R.G.; Riccal Dale 44/68; D.R.G.
R. pedemontanus Pinkw. Terrington 44/67; D.R.G.
R. eboracensis Watson Great Ayton 45/51; Head of R. Foss 44/57; D.R.G.
R. tuberculatus Bab. Great Ayton 45/51; D.R.G.
R. warrenii Sudre Great Ayton 45/51; Byland Abbey 44/57; D.R.G.
Rosa caesia Smith Head of R. Foss, Yearsley 44/57; D.R.G.
Myriophyllum spicatum L. Yearsley Moor 44/57; D.R.G.
Geranium pyrenaicum Burman f. Head of R. Foss, Yearsley 44/57; D.R.G.
Anthriscus caucalis M. Bieb. Between Redcar and Marske 45/62; J. Dews.
Cuscuta epithymum (L.) L. Gundale, Pickering 44/88; K. & J. Payne.
Onopordum acanthium L. Edge of wood, Wigginton, near the York bypass 44/55; York & D.F.N.S.
Crepis paludosa (L.) Moench Head of R. Foss. Yearsley 44/57; D.R.G.
Potamogeton alpinus Balbis Newton Dale 44/89, confirmation that it is still in Pickering

Beck; YNU Bot. Sec. Excn.

Juncus subnodulosus Schrank Yearsley Moor 44/57; D.R.G. Newton Dale 44/89; YNU Bot. Sec. Excn.

Calamagrostis epigejos (L.) Roth Yearsley Moor 44/57; Newgate Bank 44/58; Grimston Moor 55/67 (here a confirmation of a pre-1930 dot in the Atlas); D.R.G.

Paris quadrifolia L. Wigginton 44/56; M. Thallon per J. Lambert.

SOUTH-WEST YORKSHIRE (VC63) (D. R. Grant)

Equisetum telmateia Ehrh. Skiers Spring Wood, Elsecar SK(43)3699; T. Schofield.

Ophioglossum vulgatum L. Near Crane Moor SE(44)2901; E. Thompson. Wrenthorpe, Wakefield SE(44)3121; R. Sunter.

Clematis vitalba L. Altofts, Wakefield SE(44)3825; introduced with Mag. Limestone ballast; J. Greaves.

Azolla filiculoides Lam. Near Skelmanthorpe SE(44)2210; J. Lucas.

Ranunculus lingua L. Shirley Pool, Askern SE(44)5612; Y.N.U. Excn. confirmation of an old record.

Ranunculus circinatus Sibth. Old Colliery site Walton, Wakefield SE(44)3517; D. R. Grant.

Ceratocapnos claviculata (L.) Liden Fox Covert Wood, Cantley SE(44)6102; E.T.

Hypericum maculatum Crantz. Chevet Terrace, Wakefield SE(44)3518; I. Lawrence.

Bryonia dioica Jacq. High Ackworth SE(44)4518; D.R.G. Edenthorpe SE(44)6206; E.T.

Malva moschata L. Ardsley Reservoir near Wakefield SE(44)2824; D.R.G.

Populus tremula L. Wombwell Woods, Wombwell SE(44)3802; T.S.

Rubus pilicatus Weihe & Nees North Dean Woods, Halifax SE(44)0822; D.R.G.

Rubus scissus W. R. C. Watson Grenoside Woods, Grenoside SK(43)3294; D.R.G.; Luddenden Dean, Halifax SE(44)0228; T.S.

Rubus robiae (W. C. R. Watson) Newton Springmill, Ossett SE(44)2820; D.R.G. detd. by A. Newton.

Rubus sciocharis (Sudre) W. C. R. Watson Calverley Woods, Calverley SE(44)2037; D.R.G. detd. by A. Newton.

Rubus nemoralis P. J. Mueller Addingfleet, Horbury SE(44)2917; D.R.G.

Rubus ulmifolius Schott. River bank Fishlake SE(44)6513; YNU Bot. Sec. Excn.

Rubus vestitus Weihe Melton Woods, High Melton SE(44)5103; T.S.

Rubus newbouldii Bab. Birky Brow Wood, Howden, Clouth SE(44)2426; T.S.

Rubus echinatoides (Rogers) Dallman Gawthorpe Ossett SE(44) 2822; D.R.G.

Rubus echinatus Lindley Arksey Ings SE(44)6006; D.R.G.

Rubus rufescens Lef. & P. J. Mueller Bagger Wood, Hood Green SE(44)3002; D.R.G.; Brown Royd Wood, Stainborough SE(44)3202; T.S.; Margery Wood, High Hoyland SE(44)2709; D.R.G.; Burghwallis Wood, Burghwallis SE(44)5411; YNU Excn.

Rubus tuberculatus Bab. Tingley SE(44)2725; D.R.G.

Rubus warrenii Sudre Birkby Brow Wood, Howden, Clough SE(44)2426; T.S.

Rosa multiflora Thumb. Upper Park Wood, Honley SE(44)1412; L. Lloyd-Evans.

Ornithopus perpusillus L. Old sand pit Dunsville SE(44)6408; E.T.

Ononis repens L. Near Scout Dike Reservoir, Penistone SE(44)2205; L. L.-E.

Sison amomum L. Near Fosterhouses SE(44)6415; YNU Bot. Sect. Excn.

Ligustrum vulgare L. Near Elsecar dam, Elsecar SK(43)3899; T.S.

Butomus umbellatus L. Old gravel pit Wakefield SE(44)3218; D. Proctor.

Eleocaris acicularis (L.) Roemer & Schutes Old gravel pit Elland SE(44)1222; J. Lucas; Anglers Country Park, near Wakefield SE(44)3715; E.T.

Cladium mariscus (L.) Pohl. Shirley Pool, Askern SE(44)5612; YNU Excn.

Carex sylvatica Hudson Tom Royd Wood, Silkstone SE(44)2903; T.S.

Carex binervis Smith Whitley Height, Crow Edge SE(44)1904; E.T.

Carex caryophyllea Latour Near Crane Moor SE(44)2901; D.R.G.

Calamagrostis epigejos (L.) Roth. Wintersett Reservoir SE(44)3715; D.R.G.

Chara vulgaris L. var. vulgaris L. & L. Canal, Calverley SE(44)2037; T.S.

MID-WEST YORKSHIRE (VC64) (D. R. Grant)

Humulus lupulus L. Shipley Glen, Near Shipley SE(44)1148; T. Schofield.
Salix pentandra L. Braythorn Lane, Braythorn SE(44)2449; T.S.
Rosa mollis Smith Near Timble SE(44)1753; E. Thompson.
Rubus scissus W. C. R. Watson Near Blubberhouses SE(44)1556; T.S.
Rubus sciocharis (Sudre) W. C. R. Watson East Wood, Weston, Near Otley SE(44)1847; D. R. Grant. detd. by A. Newton confirmation of an old record.
Rubus lindebergii P. J. Mueller Roadside (B6479) North of Stainforth SD(34)8168; D.R.G. detd. by A. Newton.
Rubus infestus Weihe Braythorn Lane, Braythorn SE(44)2449; D.R.G.
Rubus ulmifolius Schott Barlow Common, Near Selby SE(44)6328; T.S.
Rubus procerus Mueller Riverbank, Ilkley SE(44)1148; D.R.G.
Rubus pruinosus Arrh. Orcarber Lane, Austwick SD(34)7567; D.R.G. detd. by A. Newton.
Potamogeton berchtoldii Fieber Pond on Newby Moor, Near Clapham SD(34)7169; YNU Excn.
Nitella flexilis (L.) Agardh Ingleborough Hall Lake SD(34)7469; YNU Excn.

NORTH-WEST YORKSHIRE (VC65) (T. F. Medd)

Ranunculus lingua L. Foxglove Covert, Catterick Camp 44/19: YNU Excn.
Hypericum humifusum L. Foxglove Covert 44/19; YNU Excn.
Ribes alpinum L. Banks of R. Tees, Eryholme 45/30 T.F.M.
Rubus lindebergii P. J. Mueller Foxglove Covert 44/19 YNU Excn.
R. nemoralis P. J. Mueller Askrigg 34/99; YNU Bry. Sec. Excn. det. D.R.G. Foxglove Covert 44/19: YNU Excn. det D.R.G.
R. newbouldii Bab. Arrathorne 44/29; D.R.G.
R. echlnatoides (Rogers) Dallman Askrigg 34/99 YNU Bry. Sec. Excn. det. D.R.G. Catterick Camp 44/19; YNU Excn. Arrathorne 44/29; D.R.G.
R. eboracensis Watson Masham 44/28; D.R.G.
R. tuberculatus Bab. Aysgarth Falls 44/08; YNU Bot. Sec. Excn. det. D.R.G.
R. warrenii Sudre Masham 44/28: D.R.G.
Rosa caesia Smith Foxglove Covert 44/19; YNU Excn. det. D.R.G.
R. mollis Smith Askrigg 34/99; YNU Bry. Sec. Excn. det. D.R.G. Foxglove Covert 44/19; YNU Excn. det. D.R.G.
Lythrum salicaria L. Foxglove Covert 44/19; YNU Excn.
Meum athamanticum Jacq. Castley, nr Sedbergh 34/69 (confirmation of an old record for this area); Dr G. Fryer.
Carex laevigata Smith Foxglove Covert, Catterick Camp 44/19; YNU Excn.

CASUALS AND ADVENTIVES (E. Chicken)

This report is based on 79 records received in 1995 involving 12 individuals for 67 taxa. A selection of these is given below. A newly reported site producing a good selection of plants was at Esholt near Yorkshire Water's operational land, and the customary long list from farms in the Wakefield area was forthcoming. As this is my last report as recorder, may I thank all who have sent records over the years, especially Mr John Martin, and urge support to Mr Geoffrey Wilmore who succeeds me. The contributor is assumed to be the determiner unless otherwise stated.

Cannabis sativa L. (64) Waste ground at Esholt 44/1739 and edge of canalised R. Aire, Lowther North, Allerton Bywater 44/4027; G. T. D. Wilmore.
Chenopodium polyspermum L. (61) Newly seeded verge, Beverley bypass 54/0241; J. Dews.

Amaranthus retroflexus L. (61) Newly seeded verge, Beverley bypass 54/0241; J.D. conf. E. Chicken.

Amaranthus hybridus L. (61) Newly seeded verge, Beverley bypass 54/0241; J.D. det. T. B. Ryves.

Rumex dentatus L. (63) Woodhouse Lane Farm near Wakefield 44/2924; J. Martin det. B. K. Byrne, 1994.

Citrullus lanatus (Thunb.) Matsum & Nakai (64) Waste ground at Esholt 44/1739; G.T.D.W. also seen by A. L. Barnett and B. A. Tregale.

Cucumis melo L. (64) Waste ground at Esholt 44/1739; G.T.D.W., A.L.B. and B.A.T.

Deutzia scabra Thunb. (63) Hedgerow at Esholt 44/1839; G.T.D.W. conf. B.A.T.

Prunus cerasifera Ehrh. (61) Hedgerow at Roos 54/2929; P. J. Cook. Hedgerow at Aldbrough 54/23; A. Johnson per P.J.C.

Lathyrus odoratus L. (63) Waste ground adjacent Castlefields Industrial Estate, Bingley 44/0941; G.T.D.W.

Trifolium cernuum Brot. (64) Waste ground at Esholt 44/1839; G.T.D.W. conf. Mrs P. P. Abbott.

Euphorbia cyparissias L. (61) Roadside verge at Staxton 54/0279; E.C.

Physalis ixocarpa Brot. ex Hornem. (63) Woodhouse Lane Farm near Wakefield 44/2924; J.M., 1994.

Physalis peruviana L. (64) Waste ground at Esholt 44/1739; G.T.D.W. conf. P.P.A.

Solanum nigrum L. subsp. *schultesii* (Opiz) Wessely (63) Woodhouse Lane Farm near Wakefield 44/2924; B.K.B., B.A.T. and G.T.D.W. per J.M., 1994

Solanum physalifolium Rusby (63) Woodhouse Lane Farm near Wakefield 44/2924; B.K.B., B.A.T. and G.T.D.W. per J.M., 1994.

Cuscuta campestris Yunker (64) Growing on *Artemisia vulgaris*, on waste ground at Esholt 44/1739; G.T.D.W. conf. P.P.A.

Origanum majorana L. (63) Disused railway sidings, Manningham, Bradford 44/1633; G.T.D.W. conf. P.P.A.

Campanula persicifolia L. (64) Bank of stream, Burnsall 44/0361; P.P.A.

Crepis tectorum L. (61) Newly seeded verge, Beverley bypass 54/0241; J.D. conf. E.C.

Carthamus tinctorius L. (61) Garden bird-seed alien, Driffield 54/0258; Mrs S. Dowson det. E.C. (64) Waste ground at Esholt 44/1739; G.T.D.W.

Lactuca sativa L. (61) Newly seeded verge, Beverley bypass 54/0241; J.D. conf. E.C.

Artemisia verlotiorum Lamotte (61) Pathside near Humber Bridge 54/0325; R. M. Burton conf. E.C.

Senecio ovatus (P. Gaertner, Meyer & Scherb.) Willd. (64) Roadside near Stocks Reservoir 34/7355; P.P.A.

Phoenix dactylifera L. (64) Waste ground at Esholt 44/1739; G.T.D.W. also P.P.A. and A.L.B.

Cynosurus echinatus L. (63) Disused railway sidings, Manningham, Bradford 44/1633; B.A.T. conf. G.T.D.W.

Setaria viridis (L.) Beauv. (62) Bootham, York 44/65; T. Medd conf. E.C.

Setaria pumila (Poiret) Roemer & Schultes (61) Newly seeded verge, Beverley bypass 54/0241; J.D.

Tulipa gesneriana L. A single plant, roadside at Gisburn 34/8349; P.P.A.

Scilla bifolia L. Roos churchyard 54/2929; P.J.C.

Galanthus plicatus M. Bieb. (62) Meadow at W. Ayton 44/9883; E.C. det. Dr J. R. Akeroyd.

Crocus tommasinianus Herbert (62) Meadow at W. Ayton 44/9883; E.C.

Correction to the 1989 Report

Physalis pubescens L. The determination was challenged and the specimen was eventually submitted to Kew Herbarium and determined as *Physalis philadelphica* Lam. syn. *P. ixocarpa* Hornem. by Dr K. Vollesen.

BOOK REVIEWS

A Review of the Scarce and Threatened Ethmiine, Stathmopodine and Gelechiid Moths of Great Britain by **M. Parsons**. Pp. 130. Joint Nature Conservation Committee, Peterborough. 1996. £13.40.

This is a further review in the series produced by staff at JNCC and the second to deal with the microlepidoptera (the pyralid moths were treated by the same author in publication no. 11, 1993) and treats all five native moths in the sub-family Ethmiinae, the sole British member of the Stathmopodinae and 75 species in the Gelechiidae. The aim of these reviews is to summarize distributional and biological information on the scarcer species which, in the present review, are each allocated to one of nine status categories. Two of these categories, "Insufficiently known" (10 species) and "Indeterminate" (14 species) underline the considerable shortcomings in our current state of knowledge of these moths for it is fair to say that the Gelechiidae do not presently have a wide appeal among amateur lepidopterists.

Following some 14 pages of introduction, the information for each of the selected species is presented in a series of "data sheets", each with a standardised format. Under each species name are listed the more important synonyms, references to publications which will aid identification, distribution by vice-counties separated into old (to 1969) and recent (1970 onwards) records, habitat and ecology, status, threats, conservation and published sources. This method of presentation works well and together with the clear typeface facilitates the location and extraction of data.

The publication is largely free of typographical errors, the omission of the author's name Huemer before the dates (1988, 1993) in the identification section of *Caryocolum alsinella* on page 73 being the only one noticed by the reviewer.

This review is probably of limited value to lepidopterists without some knowledge of the groups treated and its use in the evaluation of sites for conservation and in their management is weakened by the imprecise state of knowledge of the habitat requirements for many of the treated moths. Nevertheless it is a worthwhile publication for the more experienced microlepidopterist.

HEB

The Horseflies of Yorkshire by **Andrew Grayson**. Pp. 48, with 37 figs. & 16 maps. ANDGY Publications, Kirkbymoorside. 1995. £3.00, including postage, from (and cheque/P0 made out to) Mr A. Grayson, Victoria Cottage, 39 Piercy End, Kirkbymoorside, York YO6 6DQ.

This is a splendid and concise account of the Yorkshire species of flies belonging to the family Tabanidae. In common parlance, the term Horsefly is meaningless, being applied to almost any flying insect of unusual or formidable appearance. Entomologically however, the term is restricted to the Tabanidae, a family of flies which have inevitably received a bad press owing to the bloodsucking habits of the female adults. Eleven members of the family have been positively recorded from Yorkshire, but being characteristic insects of undrained wetlands and forests, most of these are of very restricted distribution, and even the four commonest species (i.e. *Haematopota crassicornis*, *H. pluvialis*, *Chrysops caecutiens* and *C. relictus*) are by no means ubiquitous. Indeed it can be said with some confidence that most Yorkshire people have probably never encountered a true Horsefly in the county.

By means of his key to species and his highly stylized, though astonishingly life-like illustrations, Andrew Grayson's book will enable naturalists to identify any Tabanid which they find in Yorkshire. After discussing Tabanid habits and biology in general, he deals with each Yorkshire species in turn, and gives lists of all county records which he has been able to verify, and which have been plotted on the county distribution maps included in the book.

From a conservation standpoint, Tabanids are invaluable. Being essentially denizens of pristine, undisturbed habitats, these flies are early casualties of land drainage and "land improvement schemes", with the result that the Tabanid fauna throughout most of England is highly impoverished. It follows that the presence of a number of Tabanid species, other than the four commonest species mentioned above, in a locality is indicative of high quality in terms of natural habitats. For the recorder, the bloodsucking habit of the adults is highly advantageous because, unlike most insects, they search for the collector who ventures into their breeding areas!

The reviewer has pleasure in commending this excellent publication, and hopes that it will prompt a growth of interest in these beautiful and fascinating insects.

Solitary Wasps by **P. F. Yeo and S. A. Corbet**. Pp. 68, plus 4 colour and 4 b/w plates. Naturalists' Handbooks No. 3 (2nd. ed., revised). Richmond Publishing Co. 1995. £13.00 hardback, £7.95 paperback.

This edition has been updated to include new ecological knowledge of *Ammophila* and *Cerceris*, and the keys have been updated to include new species. The keys deal with the sphecid, sapygid, tiphiid, mutillid and eumenid wasps. The keys go to species level except for *Spilomena* where the investigator is directed to another book. The figures next to the relevant couplets make the keys particularly easy to use. The checklist and distribution of species has been updated. The book shows clearly how to carry out field observations, including the marking of individuals and studying nest structure, and provides a page of questions or problems that can be investigated. A list of relevant references and societies are given, including the Bees, Wasps and Ants Recording Society. This book is a "must" for all interested in solitary wasps.

MEA

Dragonflies by **Peter L. Miller**. Pp. 118, plus 4 colour plates. Naturalists' Handbooks No. 7 (2nd ed., revised). Richmond Publishing Co. 1996. £16.00 hardback, £8.95 paperback..

Changes in the second edition include a substantially rewritten text and minor changes to the keys, and the addition of the newly discovered Irish species *Coenagrion lunulatum*, and new colour illustrations from R. R. Askew's *The Dragonflies of Europe*. The keys are to the last instar larvae and their caste skins (exuvia), and adults. The figures next to the relevant couplets make identification easier. The colour plates are of 24 adult species. The text deals with the ecology, behaviour and even some physiology, of the eggs, larvae and adults. There are chapters on flight, vision, reproductive biology and egg-laying. Much other useful information is given, including a book list on all aspects of dragonflies, conservation, field studies, culture and a flight table. Finally there is a long list of references, useful addresses and an annotated checklist. This is a very comprehensive account of the British dragonflies set in a European context and a "must" for every dragonfly watcher.

MEA

Atlas of the Dragonflies of Britain and Ireland by **R. Merritt, N. W. Moore** and **B. C. Eversham**. Pp. 149, with 24 colour plates & 14 b/w figures. Institute of Terrestrial Ecology and Joint Nature Conservation Committee. 1995. £15.95.

This is an impressive book from the moment you pick it up with its coloured front cover: besides providing a distribution map for each of the resident species, information for each species is given under the headings of description, habitat, breeding biology, flight period, status and distribution, and European and world distribution. The Atlas is the result of 25 years work and is one of the most comprehensive on any invertebrate group. Five and half

pages of acknowledgements with hundreds of names indicates the great interest that is being currently shown in the dragonflies. Text is also given for Channel Island species not found in Britain and Ireland, immigants and accidentals, and possible additions to the British and Irish list. The colour plates show important dragonfly sites and field studies of adult and larval dragonflies in stationary posture. Additional tables and chapters deal with the geographical spread of records, flight periods of adults, larval recording and evidence of breeding, abundance monitoring, the history of dragonfly recording and conservation and current and possible future conservation activities. The British dragonflies are also considered as part of, and put in the context of, European species. Finally there is a very full section of references. This book is a must for all students of dragonflies.

MEA

Insects and Thistles by **Margaret Redfern**. Pp. 70, plus 4 colour and 4 b/w plates. Naturalists' Handbook No. 4 (2nd. ed., revised). Richmond Publishing Co. 1995. £13.00 hardback, £7.95 paperback.

This book deals with the insects living on or in the creeping thistle, *Cirsium arvense*, and the spear thistle, *C. vulgare*. The new edition has improved the keys, brought the nomenclature up-to-date and incorporated new findings. Insects resident in the thistle heads, stem borers and leaf miners besides those living on the outside of the plants are considered in turn. The life-cycles, parasites and predators of each species are considered. Quantitative information is subjected to key-factor analysis in developing population dynamics. Information on biological control gives an applied context to the information. Then follow the keys to the insects that have previously been considered. The figures next to the relevant couplets make the keys easier to use. Finally some information is given on collecting, rearing and preparing a reference collection of insects, and a useful set of references. An absolutely fascinating book.

MEA

Message from an Owl by **Max R. Terman**. Pp. xi+217, incl. numerous b/w plates. Princeton University Press. 1996. £17.95 hardback.

Max R. Terman is Professor of Biology at Tabor College in Kansas and his book is a record of how an abandoned great horned owlet was trained in the skills it needed to survive in the wild by a human, and how a human was given the opportunity to gain more information and an insight into the life of this species. Having to be a surrogate parent to a young untrained hungry creature cannot be easy even for someone who, like the author, has the backing of scientific knowledge. Professor Terman was more interested in returning "Stripey" the great horned owl to the wild than in keeping it for scientific study. Indeed, his main concern throughout was the fear that it would be an "imprint". How he managed to achieve its return and continue to study the bird is told in an informative and entertaining way which will prove interesting to both professionals and amateurs. Not only does the reader learn a lot about an owl's life but also, possibly unintentionally, a lot about Max Terman. It was also cheering to find towards the end of the book that even experts can be mistaken.

AIH

Birds of Algonquin Legend compiled and written by **Robert E. Nichols**. Pp. xvi+149, incl. numerous line drawings by Linda Hoffman Kimball. University of Michigan Press, Ann Arbor. 1995. $29.95 hardback.

This collection of very short stories has been gathered from the Indians of North America who created legends about the birds and animals which affected their lives which were

delivered in the age old tradition by storytellers around the fire during the winter months. Anthropologists and early settlers started collecting these tales during the 19th and early 20th centuries and this book is a selection from their compilations. For anyone interested in the natural and cultural history of North America, or as a means of introducing a young listener to folklore, *Birds Of Algonquin Legend* will provide pleasant reading. The bird illustrations at the beginning of each chapter are delightful.

AIH

...ted in Great Britain by Titus Wilson, Kendal

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Readers of *The Naturalist* will have noticed that the number of photographic illustrations has increased in recent years. Good clear photographs, suitably captioned, to accompany articles or as independent features are always welcome.

To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record this deep appreciation of this imaginative gesture.

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PEMPHREDONINE WASPS (HYMENOPTERA: SPHECIDAE, PEMPHREDONINAE) OF WATSONIAN YORKSHIRE

MICHAEL E. ARCHER
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The pemphredonine wasps are medium small to very small sphecids, which although often abundant, are easily overlooked by collectors because of their size. Some species of *Passaloecus* and *Pemphredon* are often found in gardens. *Pemphredon lugubris* can be observed collecting black bean aphids from broad bean plants. Most species are black, although species of *Psen (Mimesa)* have red on part of their gaster.

Currently there are 23 species of pemphredonine wasps present in Watsonian Yorkshire in seven genera (Table 1). The species of *Psen* will be considered under the subgenera *Mimesa* and *Mimumesa* (Table 1). *Mimesa* and *Mimumesa* are given generic status in Lomboldt (1975), Bohart and Menke (1976), and Dollfuss (1991). Up-to-date keys to the pemphredonine wasps can be found in Richards (1980), Dollfuss (1991) and Yeo and Corbet (1995).

TABLE 1
Records and distributional units of the Pemphredoninae from Watsonian Yorkshire to April 1996.

Species	No. records	No. localities	No. 1km	No. 10km	No. VCs
Mimesa bicolor	1	1	1	1	1
Mimesa equestris	84	24	24	17	4
Mimesa lutaria	10	6	6	6	2
Mimumesa dahlbomi	32	25	24	20	5
Psenulus concolor	18	18	17	11	4
Psenulus pallipes	31	23	22	19	4
Spilomena beata	3	1	1	1	1
Spilomena differens	2	1	1	1	1
Spilomena troglodytes	13	10	9	8	3
Stigmus solskyi	8	6	6	4	3
Pemphredon enslini	1	1	1	1	1
Pemphredon inornatus	51	37	37	30	4
Pemphredon lethifer	33	26	26	20	4
Pemphredon lugubris	137	84	78	44	4
Pemphredon morio	4	4	4	4	4
Diodontus luperus	8	8	8	7	1
Diodontus minutus	20	8	8	7	3
Diodontus tristis	71	17	14	10	4
Passaloecus corniger	21	13	13	11	3
Passaloecus gracilis	14	13	13	11	4
Passaloecus insignis	15	12	12	11	4
Passaloecus monilicornis	11	9	8	8	4
Passaloecus singularis	30	25	25	19	4
TOTAL	618	177	165	74	5

Life Cycles and Habits

The pemphredonine wasps are summer insects, with the adults active mainly during June.

July and August but also exceptionally before and after these summer months (Table 2). Each species probably passes through one generation a year, i.e.showing univoltinism.

TABLE 2
Seasonal appearance of adults of Pemphredoninae from Watsonian Yorkshire.

	April	May	June	July	August	Sept.	Oct.	Unknown
Mimesa bicolor					1			
Mimesa equestris			7	38	33	3		3
Mimesa lutaria			1	4	3			2
Mimumesa dahlbomi		1	13	13	3			2
Psenulus concolor		1	11	6				
Psenulus pallipes	1		7	14	8	1		
Spilomena beata			1	2				
Spilomena differens				1	1			
Spilomena troglodytes			1	4	6	1		1
Stigmus solskyi			1	3	4			
Pemphredon enslini								1
Pemphredon inornatus		2	22	15	8			4
Pemphredon lethifer		1	9	8	6	1		8
Pemphredon lugubris		8	39	45	25	3	1	16
Pemphredon morio			1	3				
Diodontus luperus			1	6	1			
Diodontus minutus			1	7	9	2		1
Diodontus tristis		1	12	26	25	6		1
Passaloecus corniger			6	7	5	3		
Passaloecus gracilis			6	6	1			1
Passaloecus insignis			4	6	4	1		
Passaloecus monilicornis			1	7	2			1
Passaloecus singularis			12	12	5			1

Species of *Mimesa* and *Diodontus* are subterranean nesters, excavating their burrows in sandy or other easily-worked soils. The burrows of *Mimesa* are at first vertical before turning to become horizontal and leading to several cells. The much branched burrows of *Diodontus* each end in a cell. Each cell of *Mimesa* is stored with 12-20 leaf-hoppers (Cicadellidae) while each cell of *Diodontus* has about 30 aphids (Aphididae). An egg is laid in each cell after it has received at least some provisioning. After that the cell is sealed. *Mimesa* are attacked by the chrysid wasp, *Elampus panzeri* (Fabricius), and both *Mimesa* and *Diodontus* could be host to the mutillid wasp, *Myrmosa atra* Panzer.

Species of *Mimumesa, Psenulus, Pemphredon, Passaloecus, Stigmus* and *Spilomena* are aerial nesters in hollow plant stems, e.g. elder, raspberry, bramble, rose; in abandoned beetle borings in dead wood; and in ready-made cavities, e.g. deserted galls. *Pemphredon* also excavates burrows in decayed wood. Each burrow leads to several cells arranged either linearly or with some branching. *Mimumesa* provisions its cells with leaf-hoppers (Cicadellidae) and plant-hoppers (Delphacidae). The provisions of *Psenulus pallipes, Pemphredon, Passaloecus* and *Stigmus* are aphids (Aphididae); *Psenulus concolor* are psyllids (Psyllidae); and *Spilomena* are thrips (Thysanoptera). Each burrow usually leads to 3-12 cells although each female of *Pemphredon lethifer* may make up to four burrows. The number of prey per cell varies from 14-24 for *Psenulus concolor* and 27-73 for *Spilomena singularis.*

The chrysid wasps *Omalus* use *Pemphredon* and *Passaloecus* as their hosts. *Trichrysis cyanea* (Linn.) also uses *Pemphredon* as its host. Females of *Passaloecus corriger* steal prey from the cells of *P. insignis* and *P. gracilis.*

Further biological information on the pemphredonine wasps can be found in Spooner (1948), Yarrow (1969), Danks (1971), and Corbet and Backhouse (1975).

Historical Account

Work on the pemphredonine wasps started with Smith (1852, 1858) who discovered six species: *Mimesa equestris* (as *M. bicolor*), *M. lutaria* (as *M. equestris*), *Pemphredon inornatus* (as *Cemonus unicolor*), *P. lugubris*, *Diodontus minutus* and *Passaloecus gracilis* (as *P. insignis*). Perkins in Fordham (1933) indicated that Smith could not distinguish between *M. equestris* and *M. lutaria*, but the descriptions given by Smith (1858) indicate that he could distinguish the two species. Smith (1858) does not give specific Yorkshire localities and it is assumed that the specimens were taken at Woolley, near Wakefield. I refer to Smith's records from this locality as Woolley (F. Smith).

Roebuck (1877, 1880) listed the six species of Smith, and Roebuck (1907) added two further species: *Psenulus pallipes* and *Passaloecus singularis* (as *P. gracillis*).

Butterfield and Fordham (1931) listed 14 species including the following four new species: *Mimumesa dahlbomi*, *Pemphredon lethifer*, *Diodontus tristis* and *Passaloecus insignis* (as *P. monilicornis*). Two further species listed by Butterfield and Fordham (1931) have been rejected: *Mimesa bicolor* and *Diodontus luperus*. Specimens of *M. bicolor* collected by Fordham at Allerthorpe Common, found at Manchester and Scarborough Museums, were found to be *M. equestris*. Perkins examined specimens of *D. luperus* and found them to *D. tristis* (as recorded on the Fordham cards).

Yarrow (1969) on *Spilomena* and Yarrow (1970) on *Passaloecus* established the number of species in the British fauna and corrected the nomenclature, particularly of *Passaloecus*, which was previously confused.

This paper introduces a further eleven species which are listed with the reference in which they were first mentioned: *Mimesa bicolor* (Burn, 1975), *Psenulus concolor* (Archer, 1986), *Spilomena beata* (Archer, 1990), *S. differens* (not previously considered), *S. troglodytes* (Yarrow, 1969), *Stigmus solskyi* (Hincks, 1944), *Pemphredon enslini* (Archer, 1987), *P. morio* (Archer, 1987 as *P. clypealis*), *Diodontus luperus* (Whiteley, 1988), *Passaloecus corniger* (Archer, 1987) and *P. monilicornis* (Yarrow, 1970).

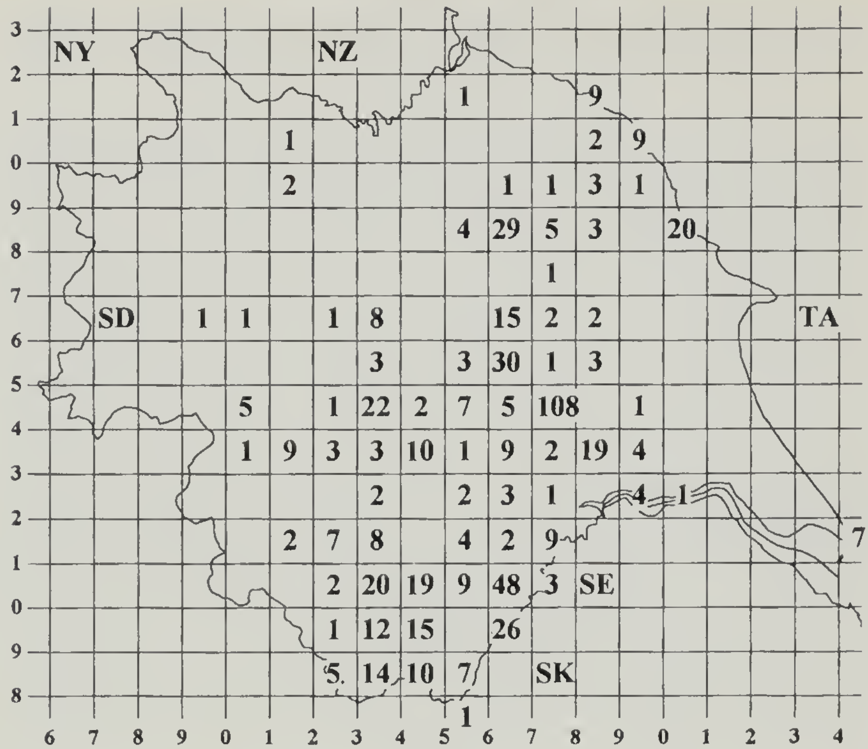
The Record Data Base

The 23 species are represented by 618 records from 177 localities in 165 1km squares or 74 10km squares (Table 1). A record is based upon a specimen where the data varies in one of the following: name, sex, locality and day-date of capture or observation. The author has seen the specimens of 384 (62%) of the records.

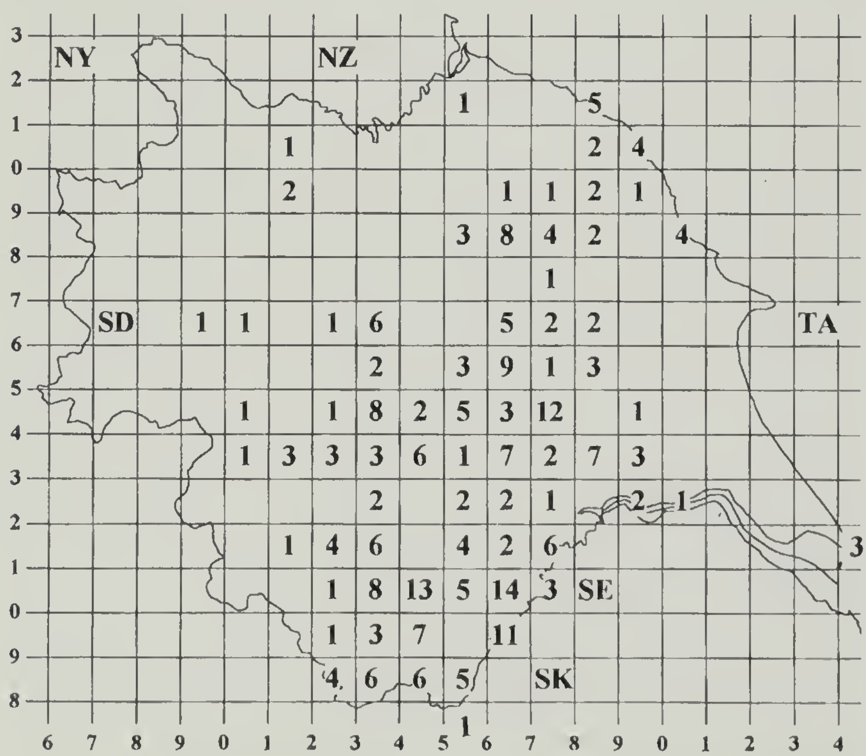
Watsonian Yorkshire may be considered to include, at least in part, 195 10km squares. Map 1 shows the number of records, and Map 2 the number of species, found in each 10 km square. Records are known from 38% of the 10km squares.

The coverage of the vice-counties is uneven with most records from VC63 (244) followed by VC61 (166), VC62 (136), VC64 (69) and VC65 (3). The following natural areas have been reasonably well sampled: North Yorkshire coastal fringe, Vale of Pickering, Vale of York, Magnesium Limestone hills, Humberhead Level, Sandstone hills (Coal Measures) and the Millstone Grit Pennines. A start has made to sample the North York Moors and Howardian Hills but more work is needed. In contrast, the Tees lowlands, Vale of Mowbray, Limestone Pennines, Yorkshire Wolds and Holderness (except for Spurn Point) have been little sampled.

Using the number of records per species as a measure of abundance and the number of 1km squares in which each species occurs as a measure of range for each species, a plot of abundance versus range can be made (Fig. 1). Except for two species (*Diodontus trisits* and *Mimesa equestris*) there is a straight line relationship. The correlation coefficient of 0.98 for the straight line species is a statistically highly significant relationship ($p<0.001$) indicating that as the range of a species increases so does its abundance. The regression equation for the straight line species can be expressed as: Abundance = 1.66 Range – 3.23.



MAP 1
Number of records for each 10km square of Pemphredoninae from Watsonian Yorkshire.



MAP 2
Number of species for each 10km of Pemphredoninae from Watsonian Yorkshire.

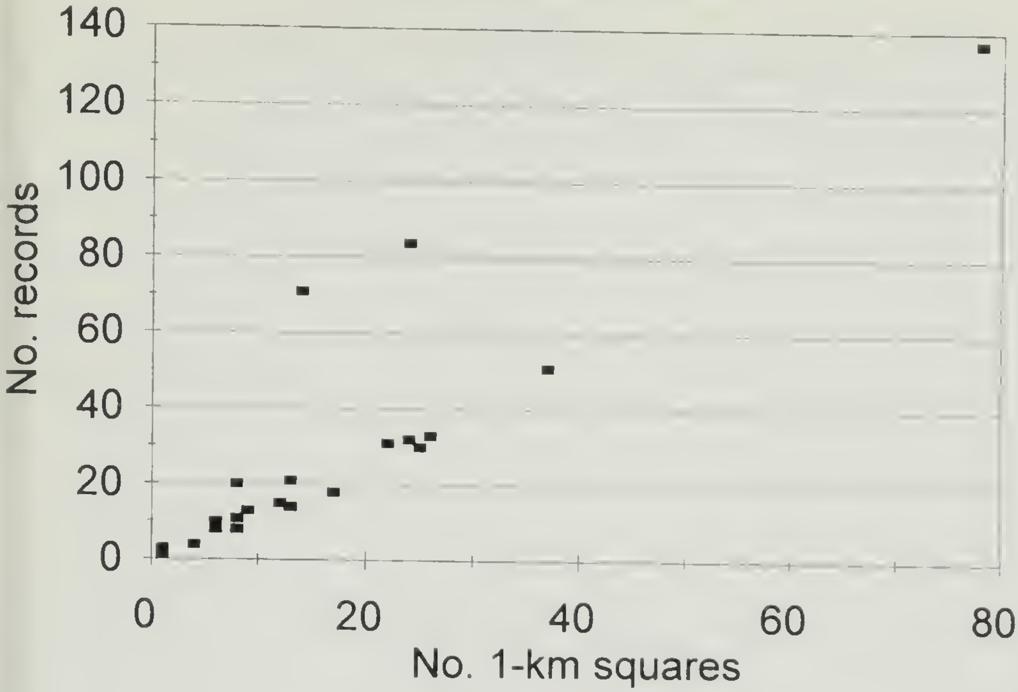


FIGURE 1
Abundance v. range of species of Pemphredoninae from Watsonian Yorkshire.

Archer (1994) defined the term "local" as a species having relatively more records from relatively fewer localities. The range and abundance data of *D. tristis* and *M. equestris* indicate that these species can be considered local species and indeed tend to be restricted to sandy habitats. Archer (1994) also considered that *D. minutus* was a local species, a conclusion that cannot now be justified by the new data.

TABLE 3
Localities from Watsonian Yorkshire with either ten or more records of six or more species of Pemphredoninae.

	No. Species	No. records
axton Common	12	18
llerthorpe Common	9	98
ow Wood	9	14
outh Cliffe Common	7	17
igset Wood	7	12
incombe Park	6	24
nd Hutton	6	11
iorne Moor	6	9
irton Leonard Lime Quarries	6	8
anvers Colliery	6	7
oolley (F. Smith)	6	6
owell Wood	6	6
ensall Common	5	13
swick Fitts	5	13
ssington Bridge	5	12
rnelian Bay	4	13
incarr Plantation	3	11
iarmcliffe Wood	3	10

TABLE 4
Time source of records of Pemphredoninae from Watsonian Yorkshire.

	No. records
Pre-1990	9
1900s	7
1910s	16
1920s	76
1930s	35
1940s	18
1950s	7
1960s	27
1970s	86
1989s	212
1990s	121

TABLE 5
Names and years of activity of collectors of Pemphredoninae from Watsonian Yorkshire with ten or more records.

	No. records	Years of activity
Archer, M. E.	209	1967-1995
Fordham, W. J.	78	1915-1935
Burn J. T.	61	1970-1991
Coldwell, J. D.	44	1985-1995
Ely, W. A.	20	1980-1991
Shaw, R.	16	1989-1992
Wood, J.	16	1927-1961
Hincks, W. D.	13	1942-1953
Flint, J. H.	12	1965-1977
Grayson, A.	11	1987-1990
Britten, H.	11	1935-1937
Whiteley, D.	10	1984-1990

TABLE 6
Sources of records of Pemphredoninae from Watsonian Yorkshire

	No. records
Doncaster Museum	17
Keighley Museum	7
Leeds Museum	7
Manchester Museum	32
Oxford Museum	1
Rotherham Museum	28
Scarborough Museum	21
Sheffield Museum	23
York Museum	1
Private collections	376
Sighted records	6
Literature records	99

TABLE 7

Number of records of the sexes of Pemphredoninae from Watsonian Yorkshire to April 1996.

	Female	Male	Unknown
Mimesa bicolor	0	1	0
Mimesa equestris	43	19	22
Mimesa lutaria	5	0	5
Mimumesa dahlbomi	12	11	9
Psenulus concolor	9	6	3
Psenulus pallipes	12	4	15
Spilomena beata	2	1	0
Spilomena differens	1	1	0
Spilomena troglodytes	7	1	5
Stigmus solskyi	1	0	7
Pemphredon enslini	0	0	1
Pemphredon inornatus	16	21	14
Pemphredon lethifer	6	12	15
Pemphredon lugubris	83	21	33
Pemphredon morio	3	0	1
Diodontus luperus	1	3	4
Diodontus minutus	10	4	6
Diodontus tristis	30	35	6
Passaloecus corniger	6	6	9
Passaloecus gracilis	5	5	4
Passaloecus insignis	5	2	8
Passaloecus monilicornis	3	6	2
Passaloecus singularis	11	9	10

Why is it that *D. tristis* and *M. equestris* have an increased chance of being recorded vhen a suitable habitat is visited? It is not because these two species are active as adults onger than other species of pemphredonines (Table 2) and so have an increased chance of being observed. Females of *M. equestris* tend to dig their burrows near each other and the urrows of *D. tristis* are probably largely restricted to banks. These colonial habits would make the two species more visible and more likely to be recorded.

The top 18 localities with either ten or more records, or six or more species, are given in able 3. All these localities are characterised by having open aerial nesting sites but may e sandy habitats, e.g. Blaxton and Allerthorpe Commons, or clay habitats, e.g. Duncombe ark and Burton Leonard Lime Quarries. The large number of records from Allerthorpe ommon indicates the great attention it has recorded since 1921.

Table 4 shows the number of records known from the 19th century and each decade of ne 20th century. The year date of four records is unknown. Table 5 shows the twelve ollectors of records with ten or more records. Little work was carried out during the 19th nd the first decade of the 20th century. During the next three decades (1910s to 1930s) an creased interest was shown, particularly by the work of H. Britten on the North Yorkshire astal fringe, W. J. Fordham mainly at Allerthorpe Common but also elsewhere, and J. ood at several localities including Aberford and around Keighley. The 1940s and 1950s ere a low point of interest, only kept alive by W. D. Hincks working at several localities, cluding Askham Bog and Spurn Point. From the 1960s there has been a great renewal of terest, greatly aided by better identification books. A characteristic of this latter period is e great increase in the number of records, being mainly the work of three aculeate orkers, M. E. Archer, J. T. Burn and J. D. Coldwell.

Table 6 shows the sources of records, with 16.0% from published and unpublished

literature, 22.2% from museum collections and 61.8% from private collections or sighted records. The collections at Doncaster, Manchester, Rotherham, Scarborough and Sheffield have been particularly important sources of records, and the help given by the curators of the nine museums and the 49 people who have been the collectors is acknowledged.

SPECIES ACCOUNTS

The information for each species is given in the following order: Biological name; Status (Archer, 1993); Map number if a map given, or if no map is given the 10km squares are indicated (B = records before 1950, A= records 1950 onwards); Seasonal appearance of adults (Table 2); Relative abundance of each sex (Table 7); National status (Archer, 1995), and national seasonal appearance of adults. As the national status of many of the species is poorly known, those given are often tentative. Localities are given for rare species.

Mimesa bicolor (Jurine, 1807)

Rare; SK69A (Crow Wood); August; male only found; nationally rare (RDB2), May until August.

Mimesa equestris (Fabricius, 1804)

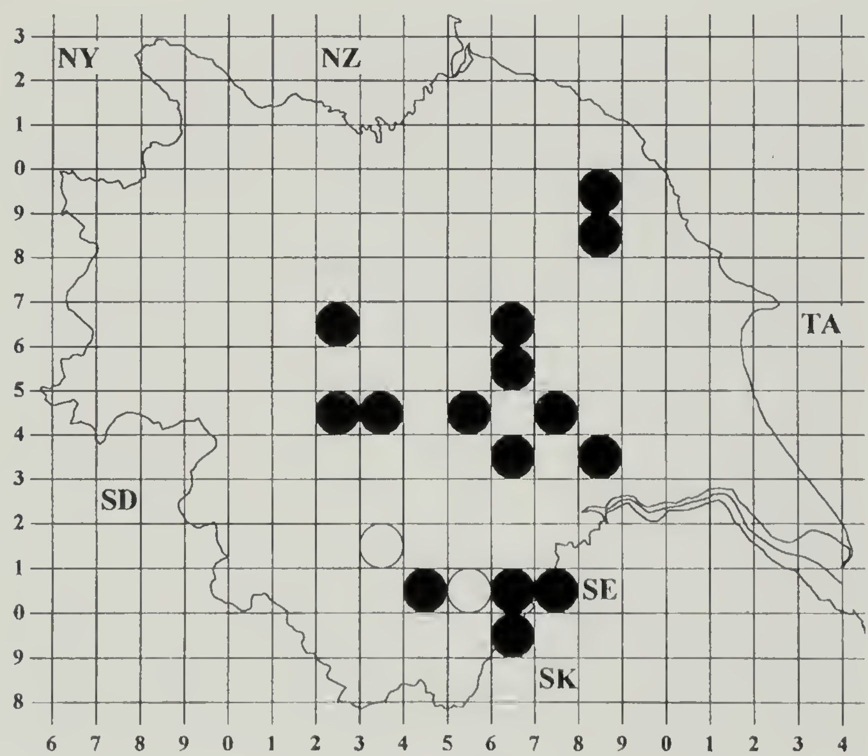
Frequent; Map 3; June until September; females more frequently found; nationally universal, June until September.

Mimesa lutaria (Fabricius, 1787)

Rare; SE23B (Farnley), SE31B (Woolley, F. Smith), SE60A (Blaxton Common), SE83A (South Cliffe Common), SE94B (Thorpe), SK69A (Crow Wood); June until August; females more frequently found but sample size is small; nationally widespread, June until August.

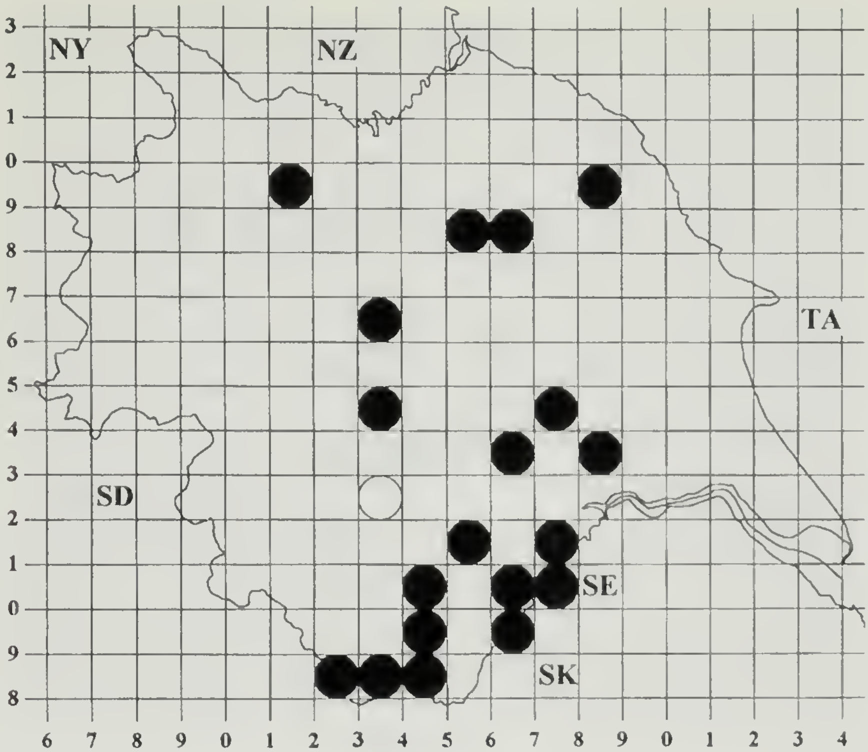
Minumesa dahlbomi (Wesmael, 1852)

Frequent; Map 4; May until August; sexes more-or-less equally found; nationally universal, May until September.



MAP 3

Mimesa equestris (Fabricius, 1804) (○ before 1950, ● 1950 onwards).



MAP 4
Mimumesa dahlbomi (Wesmael, 1852) (○ before 1950, ● 1950 onwards).

Psenulus concolor (Dahlbom, 1843)
Occasional; SE30A, SE35A, SE36A, SE40A, SE50A, SE51A, SE64A, SE65A, SE74A, SK38A, SK39A; May until July; females more frequently found; nationally widespread, May until August.

Psenulus pallipes (Panzer, 1798)
Frequent; Map 5; June until September (one record during April), females more frequently found; nationally widespread, May until September.

Spilomena beata Bluthgen, 1953
Rare; SE30A (Hugset Wood); June until July; females and male found; nationally widespread, June until August.

Spilomena differens Bluthgen, 1953
Rare; SE20A (Clough Wood); July until August; female and male found; nationally widespread, June until September.

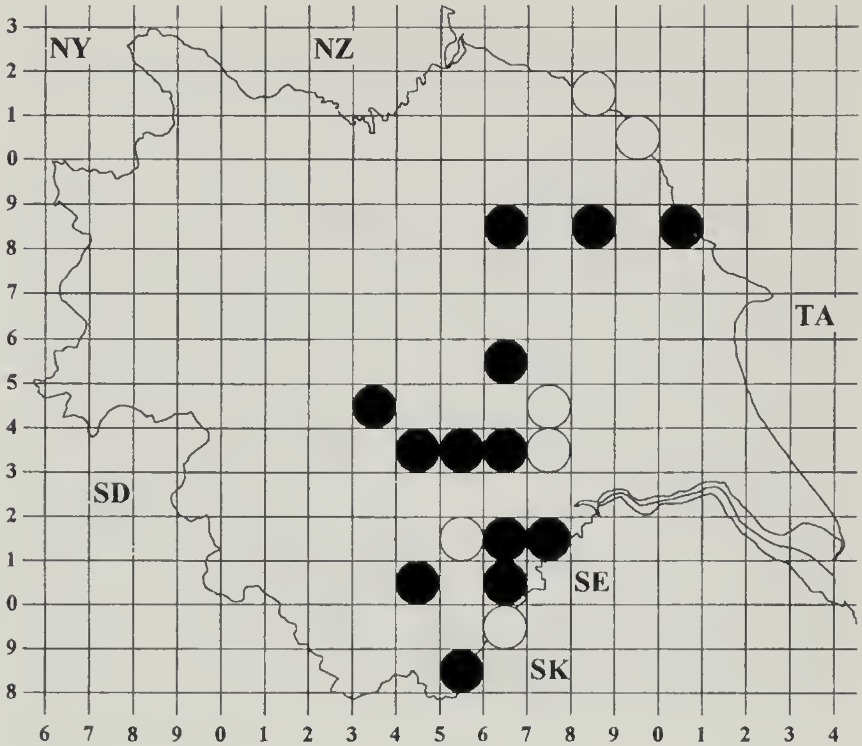
Spilomena troglodytes (Van der Linden, 1829)
Occasional; SE23B, SE40A, SE50A, SE71A, SK48A, SK49A, SK57A, TA41A; June until September; females more frequently found; nationally universal, June until September.

Stigmus solskyi Morawitz, 1864
Occasional; SE40A, SE54B, SE60A, SE92A; June until August; nationally widespread, June until August.

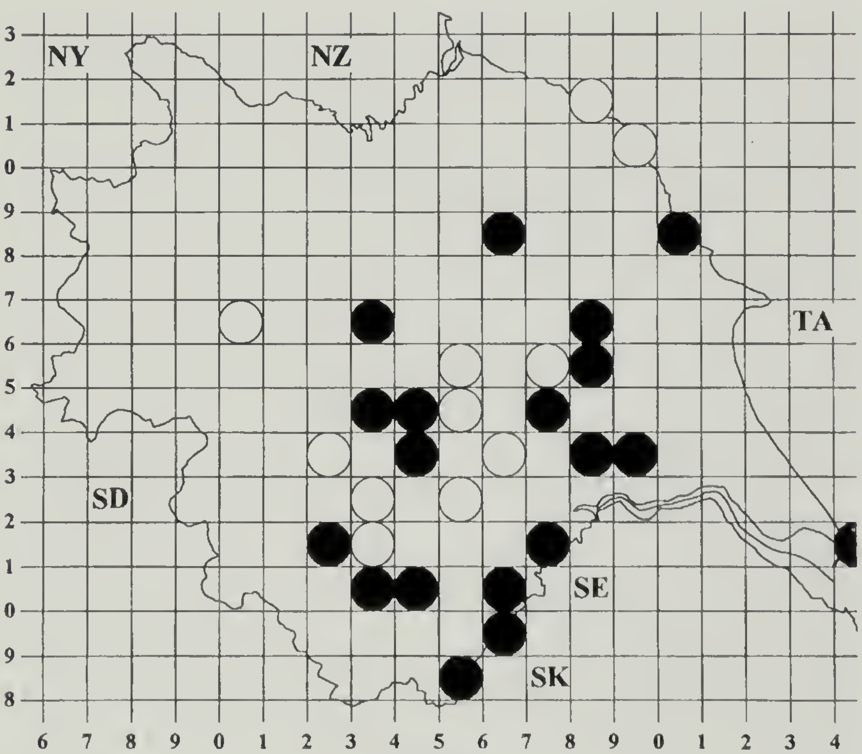
Pemphredon enslini (Wagner, 1932)
Rare; NZ10B (Richmond Park), undated specimen at Oxford University Museum; nationally rare (RDB3), July.

Pemphredon inornatus Say, 1824
Common; Map 6; May until August; males more frequently found; nationally universal, May until September.

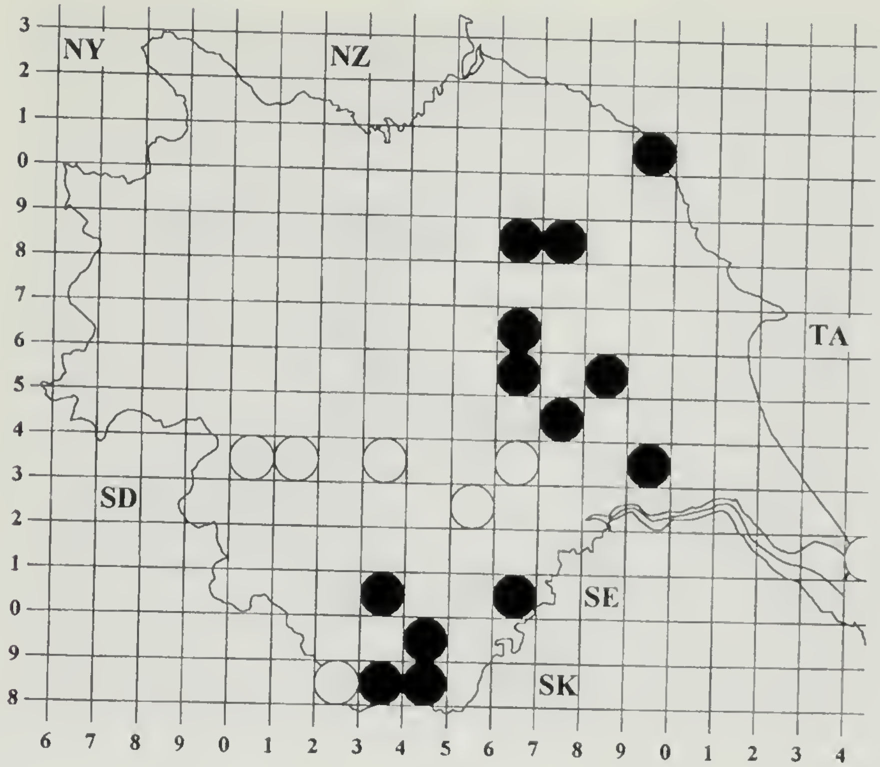
Pemphredon lethifer (Shuckard, 1837)



MAP 5
Psenulus pallipes (Panzer, 1798) (○ before 1950, ● 1950 onwards).



MAP 6
Pemphredon inornatus Say, 1824 (○ before 1950, ● 1950 onwards).



MAP 7
Pemphredon lethifer (Shuckard, 1837) (○ before 1950, ● 1950 onwards).

·requent; Map 7; May until September; males more frequently found; nationally universal, May until September.

empledon lugubris (Fabricius, 1793)

ommon; Map 8; May until October; females more frequently found; nationally universal, May until October.

emphredon morio Van de Linden, 1829

are; SE40A (Manvers Colliery), SE61A (Ashfield), SE68A (Duncombe Park), SE86A Burdale); June until July; females more frequently found but sample size small; nationally carce (Nb), June until August.

iodontus luperus Shuckard, 1837

are; SE40A (Cortonwood Colliery), SE60A (Blaxton Common), SE69A (Crow Wood), K38A (Crookesmoor & Richmond Road, Sheffield), SK48A (Shirtcliff Wood, Sheffield), K49A (Old Denaby), SK69A (Rossington Bridge); June until August; males more equently found but sample size small; nationally widespread, June until September.

iodontus minutus (Fabricius, 1793)

ccasional; SE31B, SE55A, SE60A, SE62B, SE74A, SE83A, SK69A; June until ptember; females more frequently found; nationally universal, June until September.

iodontus tristis (Van der Linden, 1829)

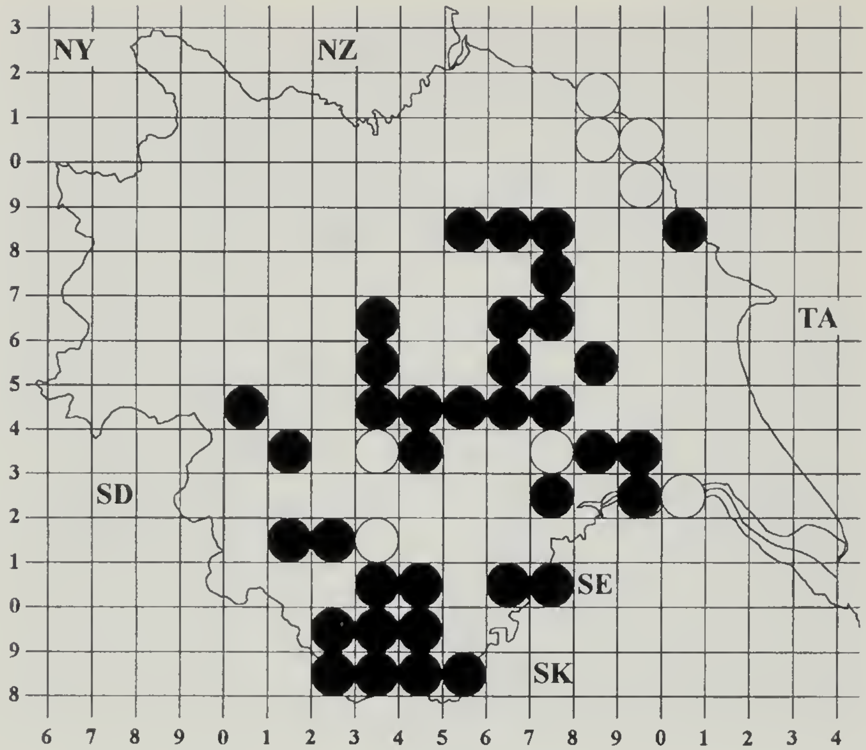
equent; Map 9; May until September; sexes more-or-less equally found; nationally despread, May until September.

issaloecus corniger Shuckard, 1837

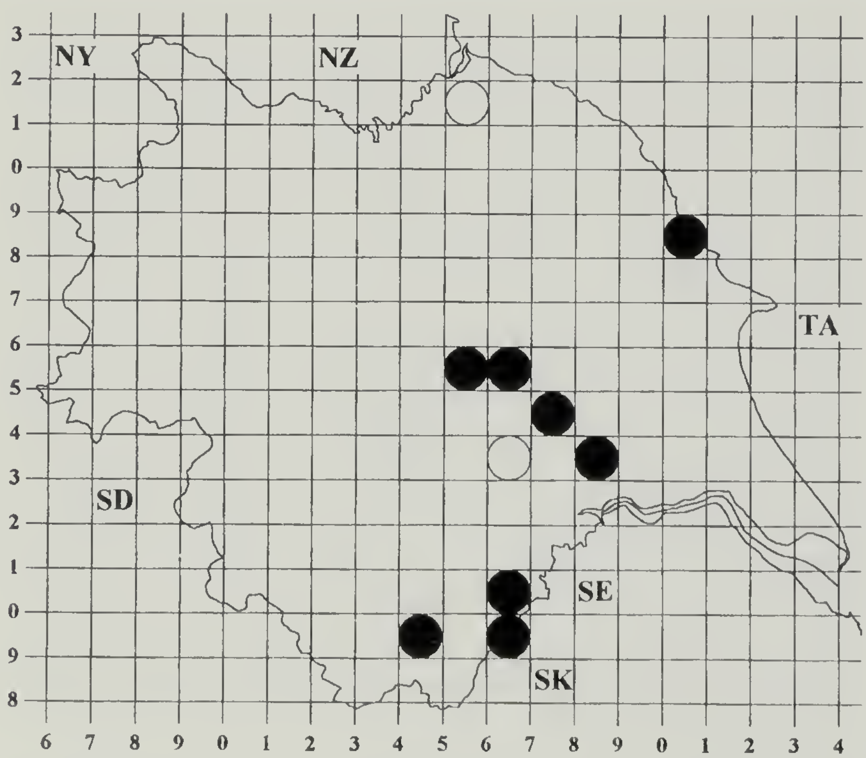
equent; Map 10; June until September; sexes more-or-less equally found; nationally despread, May until September.

issaloecus gracilis (Curtis, 1834)

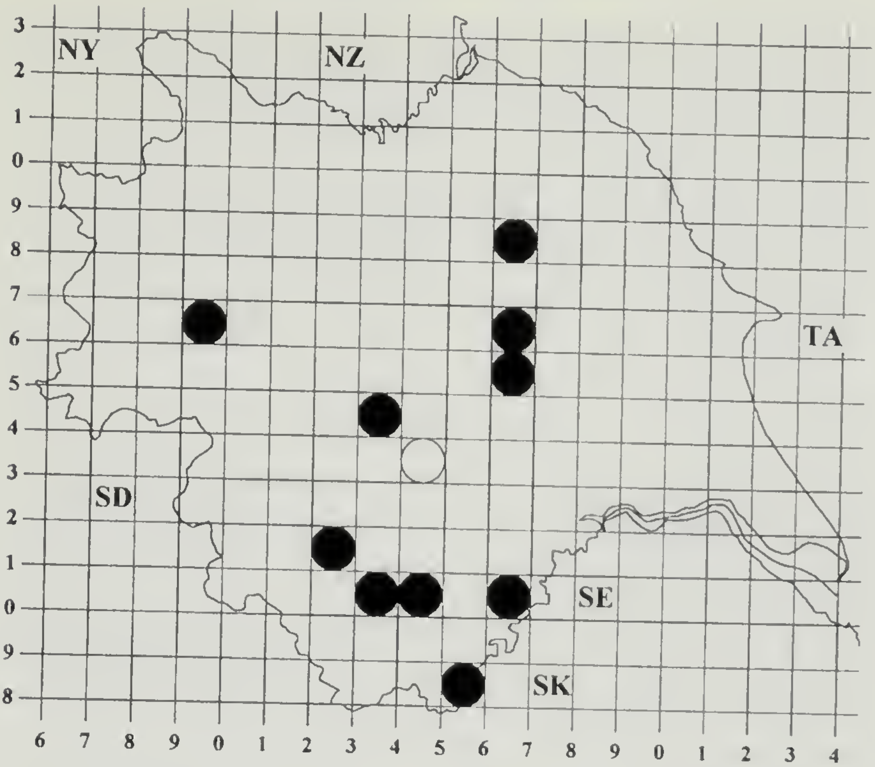
casional; SE13A, SE31B, SE34A, SE40A, SE43A, SE50A, SE60A, SE63B, SE71A, 74B, SE78A; June until August; sexes more-or-less equally found; nationally



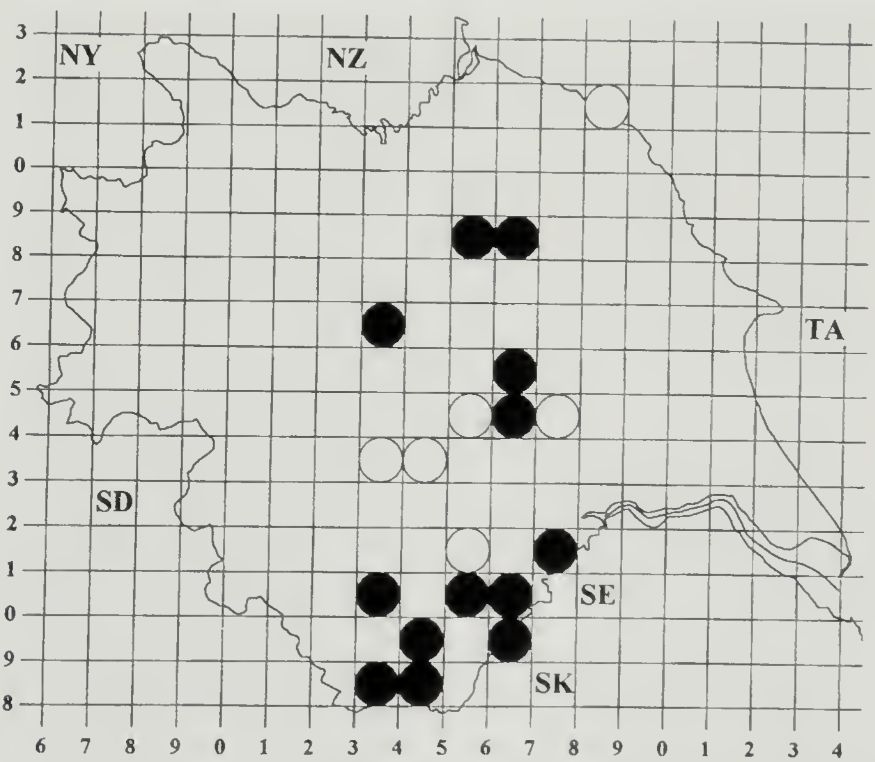
MAP 8
Pemphredon lugubris (Fabricius, 1793) (○ before 1950, ● 1950 onwards).



MAP 9
Diodontus tristis (Van der Linden, 1829) (○ before 1950, ● 1950 onwards).



MAP 10
Passaloecus corniger Shuckard, 1837, (○ before 1950, ● 1950 onwards).



MAP 11
Passaloecus singularis Dahlbom, 1844, (○ before 1950, ● 1950 onwards).

widespread, June until August.

Passaloecus insignis (Van der Linden, 1829)

Occasional; SE30A, SE34B, SE36A, SE40A, SE62A, SE65A, SE74B, SK28A, SK39A, SK58A, SK69A; June until September; females more frequently found; nationally widespread, June until September.

Passaloecus monilicornis Dahlbom, 1842

Occasional; NZ80B, NZ81B, SE19A, SE21A, SE66A, SE76A, SE78A; June until August: males more frequently found; nationally widespread, May until September.

Passaloecus singularis Dahlbom, 1844

Frequent; Map 11; June until August; sexes more-or-less equally found; nationally universal, April until September.

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BOOK REVIEWS

The Lepidoptera: Form, Function and Diversity by **Malcolm Scoble**. Pp. 404, with 321 line drawings and black and white photographs and 34 colour photographs arranged as four plates. The Natural History Museum and Oxford University Press, 1995. £25.00 paperback.

This lively account of the functional morphology and classification of the world's butterflies and moths is the first comprehensive treatment for some 40 years. It is divided into three sections. Part I is a thorough review of form and function, concentrating on external morphology rather than internal anatomy. Chapters on the head, thorax and abdomen of the adult stage cover in detail the structure of that part of the body and its associated organs and appendages. The style is notable for its clarity and the clever blending of morphological description with the broader context of functional significance in the biology and life style of Lepidoptera. Taking wings, for example, variation in shape and size leads into the question of why wing reduction in the females of some species should have evolved. Wing structure, methods of folding, and patterns of venation and their use in classification are described. The different resting postures of wings and the variety of wing coupling and locking devices are followed by a section on scales. Flight (the primary function of wings) and migration are covered in detail, as are the colours and patterns on wings: the ways in which colour is produced and its significance in crypsis, aposematicism, mimicry, false heads, eyespots, communication and thermoregulation (secondary functions). A further chapter deals with the immature stages and Part I concludes with communication through sound and scent and the associated organs.

Part III addresses classification down to the level of family or subfamily. For each, the main features on which the classification is based are outlined, together with a brief overview of the biology and possible phylogenetic relationships of the group. What emerges strongly is the difficulty in recognising monophyletic groups and the great degree of uncertainty regarding lepidopteran systematics.

Squeezed between the other two, Part II is a single brief chapter on the environmental and ecological importance of Lepidoptera. The main theme is their importance as primary consumers, having about the same number of phytophagous species as the Coleoptera. In turn, they are an important source of food or hosts for many other animals. It is not surprising, therefore, that they should be considered as good candidates for indicators of environmental change or habitat quality.

With a reference list of over 700 entries, and the relatively recent literature well represented, this is an important book for all with an interest in Lepidoptera. It is outstandingly readable, good to dip into, and packed with information. I wonder, for example, how many readers of this review are aware that Hawaiian members of the same genus as our familiar little pug moths have larvae that are carnivorous, striking out at and seizing with their thoracic legs other insects and spiders.

TJC

John Muir: Apostle of Nature by **Thurman Wilkins.** Pp. xxvii + 302, including 23 illustrations. University of Oklahoma Press, Norman and London. 1995. £19.95 hardback.

John Muir (1838-1914) has many claims to be the founding father of "the preservation wing of the conservation movement". Much of his life was dedicated to a crusade for the protection of Wilderness values. He founded the Sierra Club, was active in the campaign to establish national parks and forest reservations in the USA, and has become something of a cult figure. He had a complex character, being arctic explorer, wealthy farmer, essayist, tramp and eccentric as well as conservation pioneer and something of a geologist. Although America claims him, he was in fact Scots by parentage, birth and early life, and was extremely proud of his heritage, never losing his accent, and only becoming an American citizen at the age of sixty-five. He was a life-long devotee of Burns and Scott.

Although he retained his Scottishness, Muir loved America. In his essay *The American Forests*, in 1897 he wrote:

> The forests of America . . . must have been a great delight to God; for they were the best he ever planted. The whole continent was a garden, and from the beginning it seemed to be favoured above all the other wild parks and gardens of the globe.

It was passages like this that "evoked the myth of America as Paradise Regained", as the biographer puts it, and conveyed to the American people the fear that their heritage was in danger, ultimately galvanising some of them into action.

This well written, concise biography is largely based on previously published sources – of which there are a great number – rather than on archival material, but is none the worse for that. The arrangement of the book, following a Prologue that describes the social and philosophical background of the USA in the period in which John Muir lived, is chronological. Twenty-three chapters take the reader through an eventful life, from childhood and schooldays in Dunbar on the east coast of Scotland to the final weeks in California. The author is sympathetic, yet does not gloss over certain flaws in his subject's character, which in part are attributed to the extreme religiosity and bigotry of his austere, fundamentalist father, and the frequent beatings (inflicted, sometimes, almost daily) in Muir's childhood. We glimpse, all too briefly, this childhood, including an adventure on the steep roof of his Dunbar house which he later linked to his love of mountaineering. We join Muir in his youth in the wilds of Wisconsin, and share his enthusiasm for extraordinary inventions, including an early rising machine which tipped him out of bed in the morning, and "loafer's chair" which exploded when someone sat in it! We follow his "skedaddling" to Canada to avoid the draft at the time of the Civil War, and his "Thousand-mile walk" from Indianapolis to the Gulf of Mexico in early manhood. But the backdrop to much of Muir's life was the American West: the Sierra, the redwood forests, Yosemite Valley and Alaska, which he explored when they were still very wild and later campaigned with heart and soul to protect. The later chapters of the book detail these strivings. Chapter 24, however, is entitled "The lore of a literary naturalist" and evaluates John Muir's writing – the biographer is a former professor of English. This is followed by a philosophical Epilogue and an excellent set of Bibliographical Notes: there are few references to sources in the body of the text.

The book is balanced, although the British reader might wish for more details of the early Scots phase and of his later visits to Britain, and an eventful voyage round the world late in Muir's life is sparsely covered. While the production is generally excellent, some of the photographs have not reproduced well and occasionally the author is on unsure ground on scientific matters and over non-US place-names. The spelling of the Irish name as "Avonmore" and as "Avenmore" within six lines on page 71 is unfortunate. These are trifles however, and as a succinct summary of a life the appreciation of which is fundamental to comprehending the modern conservation movement, this book could not easily be bettered.

PA

AN INVERTEBRATE SURVEY OF HATFIELD DRAINS

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INTRODUCTION

The Hatfield Drain complex lies on the borders of North Lincolnshire and South Yorkshire, and comprises a series of major water courses, managed by the Environment Agency (formerly the National Rivers Authority) and the Hatfield Chase Internal Drainage Board into which small privately owned farm ditches drain. They are known to support a range of uncommon plants and parts are considered to be of significant nature conservation interest (Bignall, 1991), although repeated surveys of the vegetation suggest that the interest is declining, at least in terms of the numbers of nationally and regionally scarce species (Bignall, 1994).

The invertebrate interest of these ditches is less well known, with some information on aquatic invertebrates (Malard, 1989), but little else; a brief survey of the wetland invertebrate interest was therefore carried out in conjunction with further vegetation surveys in 1995 in order to evaluate the possible invertebrate interest of the drains and to provide additional information to assist consideration of some of them as possible Sites of Special Scientific Interest.

Visits were made to 19 locations on four main drains, Hatfield Waste, North Engine, North Idle and South Engine Drains, together with part of the River Torne on 19 and 21 June 1995. Emergent vegetation was sampled by sweeping and although some bankside vegetation was also swept, the main intention was to investigate the invertebrate fauna most closely associated with the drainage ditches and their associated wetlands plants. The main groups sampled were the Coleoptera, Diptera and Hymenoptera, although notes of other Orders were made and specimens of Neuroptera were retained for the relevant recording scheme.

Apart from selected families of beetles which were identified by Dr Roger Key, and the Neuroptera which were identified by Colin Plant, identifications were the author's. Some families of flies were largely ignored, especially the bulk of the Nematocera and Calypterates which were outside the normal range of species with which the author is familiar.

SITE DESCRIPTIONS

Hatfield Waste Drain and North Engine Drain

This section comprises two parallel drains to the east of the A161 divided by well grazed grass and to the west by a minor road. The eastern on is essentially well-lit and bright, with shallow banks and a diverse emergent flora, whilst the western section is in deep cuttings and in places is heavily shaded with a more limited range of emergents, ultimatedly turning to monocultures of *Phragmites australis*. Overall, North Engine Drain was the more interesting and much of Hatfield Waste Drain west of the A161 was not sampled because it proved unproductive and difficult to sample.

Hatfield Waste Drain

H1. SE78631025
A south-facing bank with *Glyceria maxima, Sparganium erectum, Carex elata* and *C. vesicaria.*

H2. SE78401040
South-facing heavily grazed sedges.

H3. SE77851065
South-facing monoculture of *Glyceria maxima.*

North Engine Drain

NE1. SE78631030
North-facing, with a rich emergent flora including *Sparganium erectum, Lythrum salicaria, Iris pseudacorus, Caltha palustris,* and *Carex elata.*

NE2. SE78401045
North-facing, with good marginal vegetation including *Caltha palustris, Alisma plantago-aquatica, Filipendula ulmaria, Lythrum salicaria, Eleocharis palustris, Carex elata* and *Pulicaria dysenterica.*

NE3. SE77901070
North-facing, with a good mixture of marginals such a *Glyceria maxima, Sparganium erectum, Eleocharis palustris, Caltha palustris* and *Oenanthe fistulosa.*

NE4. SE77501065
North-facing, in a dark tree-lined section. Vegetation rank with abundant *Filipendula ulmaria* and *Carex acutiformis.*

NE5. SE77251070
Similar to sample station H7, although the opposite bank was less shaded and had a more interesting emergent and bankside flora.

NE6. SE76801050
North-facing, with *Phragmites australis* fringe and wetland species such as *Filipendula ulmaria* and *Thalytricum flavum* further up the bank.

NE7. SE76401030
North-facing, with a fringe of *Phragmites australis.* Some *Thalytricum flavum* in the damp area behind the reeds.

North Idle Drain

Much of North Idle Drain is set in a steeply sided deep cutting which makes sampling especially difficult and dangerous. The vegetation varies, but at the northern end there are extensive *Phragmites australis* and *Sparganium erectum* beds, with more open water further south. Parts are also shaded with scrub.

NI1. SE74400860
Rank *Sparganium erectum* chokes the water-course. Some *Caltha palustris* and *Filipendula ulmaria* and where the water is open *Potamogeton natans* is abundant.

NI2. SE74350820
A mixture of *Glyceria maxima* and *Sparganium erectum* interfacing with a bed of *Phragmites australis.*

NI3. SE74250790
A mixture of *Phragmites australis* with *Potamogeton nataus* in open water.

NI4. SE74250780
A mixture of *Sparganium erectum, Potamogeton natans, Ranunculus aquatilis* agg. with a fringe of *Filipendula ulmaria.*

NI5. SE74200740
A mixture of *Spraganium erectum, Typha latifolia, Filipendula ulmaria, Caltha palustris* and *Phragmites australis.*

River Torne

A slow-moving lowland river with mainly rank marginal vegetation and associated washlands and nearby borrow-pits.

RT1. SE73700395

Very litle marginal vegetation but some *Glyceria maxima* and *Sparganium erectum.*

RT2. SE73000410

Rank marginal vegetation chiefly comprising *Gyceria maxima.*

RT3. SE72500420

Similar to station RT2.

South Engine Drain

(SED) SE74000380

A wide and heavily engineered drain with a thin band of marginal vegetation comprising *Phragmites australis, Iris pseudacorus, Filipendula ulmaria* and *Ranunculus sceleratus.*

Records and Discussion

A total of 113 species were recorded and are listed in Appendix 1. This compares with the 188 species recorded by Malard (1989) who concentrated on the aquatic Coleoptera, Hemiptera and Mollusca over a far longer survey period, covering more locations over a wider area and using more recorders. Both surveys recorded comparatively few species at each sampling station, but it is difficult to draw any firm conclusions from this as the range of species differed so much.

As can be seen in Appendix 1, few families are well represented and few species of particular note were found. The breakdown of numbers of species from each sampling location and numbers of wetland indicators is given in Table 1. From this it would appear that there is no consistency in terms of numbers of wetland species recorded from individual sample stations in the different drains, although Hatfield Waste Drain does prove to be consistently less interesting than North Engine Drain.

Among the more interesting records is the assemblage of four reed beetles (*Donacia* and *Plateumaris*) including the nationally scarce *Donacia clavipes* and *D. simplex*, both of which are listed by Hyman and Parsons (1992) as Nationally Scarce B, i.e. recorded from fewer than 100 10 kilometre squares in the UK; these species seem to be very well established in the Hatfield Drains complex. *D. clavipes* may be a recent coloniser as it was not noted from the Crowle area in the past (Dr Roger Key *pers. comm.*), although the author has recorded it elsewhere in Yorkshire and North Lincolnshire. and Stainforth (1944) considered the species likely to occur widely in lowland Yorkshire. *D. simplex* on the other hand is known from a 1907 record from Thorne (Stainforth *loc. cit.*). Among the flies, the hoverflies *Pipizella virens* and *Cheilosia velutina* are currently listed by Falk (1991) as Nationally Scarce, but the former is more widespread than previously thought (Ball & Morris in prep.) and may no longer fall into this category. The predatory fly *Hilara discoidalis*, also listed by Falk (1991) as Nationally Scarce, belongs to a genus which is characterised by males swarming over water. *H. discoidalis* occurs at a number of localities in Yorkshire, but is very local (R. Crossley *pers. comm.*); it is one of a large and difficult genus to identify, and may therefore be under-recorded.

One other noteworthy record is the presence of larvae of the mullein shark moth *Cucculia verbaski* feeding on water figwort *Scrophularia auriculata.* This is a local species which in my experience is more frequently met with on limestone or chalk, feeding on mullein flower heads. A further point of interest is the presence of meadow rue, *Thalyticum flavum*, which would be worth searching for larvae of the marsh carpet moth *Perizoma sagittata.*

TABLE 1

Sample station	Total number of species	Number of wetland species	Number of wetland species in drains
Hatfield 1	7	2	
Hatfield 3	9	2	5
Hatfield 5	4	1	
North Engine 1	13	3	
North Engine 2	15	5	
North Engine 3	16	8	
North Engine 4	10	4	17
North Engine 5	11	6	
North Engine 6	16	3	
North Engine 7	16	3	
North Idle 1	15	5	
North Idle 2	12	3	
North Idle 3	7	1	12
North Idle 4	14	5	
North Idle 5	8	2	
River Torne 1	15	2	
River Torne 2	10	2	7
River Torne 3	8	3	
South Engine Drain	13	5	5

Ignoring common or ubiquitous species, a wetland assemblage of 33 species can be discerned and wetland species are highlighted. Few families are well represented and there is a paucity of typical wetland indicators such as the Sciomyzidae and Dolichopodidae; moreover the total list masks the overall paucity of species at each sample location, averaging 11.5 with a maximum of sixteen and a minimum four species. 1995 was a poor year for invertebrate recording and this may be reflected in the species recorded from the Hatfield Drains complex. The drains did have a good amount of water in them however, and it is possible that other factors are involved such as the as yet undermined factors behind the apparent decline in the vegetation.

It is perhaps surprising that the fauna of these drains is so poorly recorded given their proximity to the important peatland reserves of Thorne and Hatfield Moors (The Humberhead Peatlands National Nature Reseve). Whilst this survey demonstrates that despite poor conditions, an interesting assemblage of wetland species is present in the Hatfield drains, there are considerable opportunities to broaden our knowledge of the fauna, especially the water beetles which were not examined during this survey. Hopefully this note will either stimulate more detailed surveys or publication of hitherto unpublished records. English Nature would also welcome records from these drains in order that their nature conservation interest can be evaluated further.

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Appendix 1

Species list for Hatfield Drains Invertebrate Survey 19-21 June 1995

Species considered indicative of the wetland assemblage for the purposes of this study listed as WET.

COLEOPTERA			
Cantharidae			
C. decipiens	NE6		
Cantharis lateralis	SED		
C. livida	RT1		
Cantharis rustica	NE6, NE7		
Rhagonycha limbata	NE6, NE7		
Carabidae			
Amara plebeja	NE1		
Demetrias atricapilus	NI1		
Chrysomelidae			
Chalcoides fulvicornis	NI3		
Crepidodera transversa	H2, NE1		
D. clavipes	H1, NE4, NE5, NE7	**Scarce B**	**WET**
Donacia simplex	H1, NE3, NI1, N13, SED	**Scarce B**	**WET**
D. thalassina	NE1, NE3, NE5		**WET**
Galerucella calmariensis	NE2, NE3		
Phaedon armoracea	NI2		
Plateumaris sericea	NE3		**WET**
Coccinellidae			
Adalia bipunctata	NE3, RT3		
Coccinella septempunctata	NE2, NE7		
C. undecimpunctata	NE7		
Propylea quattuordecipunctata	NI1		
Curculionidae			
Phyllobius pomaceus	NI2		
Elateridae			
Agriotes pallidus	NE1		
Athous haemorrhoidalis	NE1, NE7.		
A. hirtus	NI5		
Selatosomus incanus	NE4, NE6, NE7		

DIPTERA			
Asilidae			
Dioctria baumhaueri	NE7, RT2		
D. rufipes	NE6, NE7, NI1, NI4, RT1		
Conopidae			
Sicus ferrugineus	RT1		
Dolichopodidae			
Anepsomyia flaviventris	NI2, NI4		**WET**
Argyra argentella	NI4		**WET**
A. vestitata	NE2		**WET**
Dolichopus claviger	NE6, NE7		**WET**
D. festivum	NE4, NE5		**WET**
D. pennatus	RT3		**WET**
D. uliginosus	H1, H2, H3, NE2, NE3, NI1, NI5, RT1, RT2, RT3		
Hercostomus celer	NE2, NE6, NI1, NI4		**WET**
H. cupreus	RT1		**WET**
H. aerosus	NI1, NI2, RT2		**WET**
Xanthochlorus ornatus	NI1, NI2, NI5		**WET**
Empididae			
Empis caudatula	NE2		
Empis livida	RT2		
Hemerodromia raptoria	NI4		**WET**
Hilara discoidalis	NI1	**Scarce**	
H. fuscipes	NI2		
H. quadrivittata	NI2		
Hydromyia stagnalis	RT1		**WET**
Platypalpus palidiventris	N3, NE7, NI1, NI4, RT2		
P. pallidicornis	NE3, RT1		
Geomyzidae			
Geomyza tripunctata	NE1, NE2		
Lauxaniidae			
Calliopum aeneum	H2, NE6, NI2, NI3		
Minettia spp (♀)	NE6, NI5		
Lonchopteridae			
Lonchoptera lutea	NE3, NI2, NI5, RT2, SED		
L. tristis	NE1		
Opomyzidae			
Opomyza germinationis	H1, H2, NE1, NE2, NE4, NI2, RT2		
O. petrei	H1, H2, NE1, NE2, NI3		
Otitidae			
Meliera omissa	NE7		
Pipunculidae			
Dorylomorpha xanthopus	H2, NE5		

Rhagionidae			
Chrysopilus cristatus	H1, NE2, NE3, NE4, NE6, NI1		
Rhagio tringarius	NE2		
Scathophagidae			
Cleigastra apicalis	NE3		WET
Cordilura impudica	NI4		WET
Norelliosoma spinimanum	NE5		
Scathophaga furcata	NE2, NE5, N1		
S. stercoraria	NE1, NE3, NI4, SED		
Trichopalpus fraterna	RT1		
Sciomyzidae			
Limnia unguicornis	RT1		WET
L. paludicola	NE5		WET
Pherbina coryleti	NE2, NE3, RT2		WET
Tetanocera arrogans	H2, NE1, NE2, NE4		WET
T. elata	NE5, NE6		WET
T. robusta	SED		WET
Sepsidae			
Themira annulipes	H2		
Stratiomidae			
Beris vallata	H1		
Chloromyia formosa	NE1, NE6, NE7		
Syrphidae			
Anasimyia contracta	RT3, SED		WET
Cheilosia albitarsis	RT1, RT3		
C. velutina	RT1	**Scarce**	
Episyrphus balteatus	SED		
Eristalinus sepulchralis	RT1, RT2, RT3		
Eristalis tenax	SED		
Melanostoma scalare	NE4, NE5		
Neoascia meticulsa	NE4, NE5		WET
N. tenur	H2, NE1, NE2, NE3		WET
N. podagrica	H3		
Pipizella virens	NE4	**Scarce**	
Platycheirus albimanus	SED		
P. fulviventris	NI1		WET
P. manicatus	RT1		
Syritta pipiens	SED		
Syrphus ribesii	RT1, RT3		
Tropida scita	NE7		WET
Tabanidae			
Chrysops relictus	NI5, SED		
Therevidae			
Thereva nobilitata	NE7, NI4		
HEMIPTERA			
Cercopidae			
Cercopis vulneratus	NE6, NE7, NI3		

HYMENOPTERA		
Andrenidae		
Andrena chrysosceles	RT1	
Cephiidae		
Calameuta filiformis	NE3	
Cephus cultratus	NE6	
Sphecidae		
Passeloecus insignis	NI3	
Tenthredinidae		
Macrophya duodecimpunctata	NE4	
Rhogogaster chambersi	NI2	
Selandria serva	NE3	
S. sixii	NE3	**WET**
Tenthredo scrophulariae	RT2	**WET**
T. mesomelas	NI1	
LEPIDOPTERA		
Arctiidae		
Tyria jacobaeae	NE6	
Geometridae		
Camptogramma bilineata	NI1, NI3, NI4	
Xanthoroe montanata	NI1, NI4	
Hesperidae		
Ochlodes venata	NE6	
Noctuidae		
Cucullia verbasci	NE5, NI4, NI5	
Pieridae		
Anthocharis cardamines	NI2	
NEUROPTERA		
Chrysopidae		
Chrysopa perla	NI4	
Panorpidae		
Panorpa germanica	NI4	
ODONATA		
Agriidae		
Calopteryx splendens	RT3	**WET**
Coenagriidae		
Pyrosomma nymphula	HE, HI5, SED	**WET**
Libellulidae		
Libellula quadrimaculata	SED	**WET**

JOSEPH WILLIAM DUNNING (1833-1897): INFORMAL ANNOTATIONS IN A COPY OF RENNIE (1832) BY A FORGOTTEN YORKSHIRE NATURALIST TOGETHER WITH BIOGRAPHICAL NOTES

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In 1990 while researching *Butterflies of the Doncaster District* (Rimington, 1992), a series of manuscript entries was discovered largely relating to Storthes Hall (Huddersfield), Adwick-le-Street (Doncaster) and Brandon (Suffolk). The entries, which are copious and refer almost exclusively to the years 1845 to 1847, are contained in an interleaved copy of *A Conspectus of the Butterflies and Moths found in Britain* (Rennie, 1832). On the title-page is the signature of Joseph William Dunning, presumably the owner of the book prior to its donation to the Royal Entomological Society of London in whose library it now resides (catalogue reference L40.L5 REN).

At the time of writing *Butterflies of the Doncaster District* it was mistakenly believed that Dunning was a teacher at Adwick Hall school, Doncaster, during the period in which the entries were made but subsequent research revealed that he was in fact a pupil there in 1845, prior to his move with the school to Storthes Hall in 1846.

Both establishments were run by Peter Inchbald jnr. and catered for 12 to 14-year-old boys (Harrison, 1957). Peter Inchbald (1816-1896) was an accomplished ornithologist, botanist and entomologist whose life was described briefly in the *Doncaster Review* (Anon., 1898).He contributed frequent notes and records to the natural history journals of the day and was a major contributor to Porritt (1883-1886). Without doubt this early association with Inchbald proved to be a most beneficial influence on the young Dunning, not only as a scholar but also as a naturalist.

Without the assistance of a competent graphologist the link between Dunning's signature, of which two separate and corroborating examples are available, and the annotations is difficult to establish conclusively but there is little doubt even to the inexperienced eye that the likeness is remarkable. The constant references to Brandon and the frequent classical analyses of species names provide further evidence of authenticity for it is known that Dunning spent his youthful summer holidays at Brandon and was to become an accomplished classical scholar. A number of the annotations were entered initially in pencil and later overwritten in ink. This together with the classical scholarship, the evident maturity of the hand, the differing shades of ink used and the irregularity of the entries points to these having been made over an undetermined period, but most probably not later than 1850 from notes taken between 1845 and 1848.

It is not uncommon for the lifetime achievements of worthy individuals to be forgotten or overlooked by future generations. The facts revealed by our researches indicate this to be the case with Dunning, whose life and contribution to natural history, in particular to the Royal Entomological Society of London, we describe briefly in this biographical note.

Information relating to Dunning's life is taken mainly from obituary notices (Goss, 1897, 1898; McLachlan, 1897; Trimen, 1897) and to his association with the Society from Neave (1933).

Joseph William Dunning was born in Leeds in 1833, the son of a solicitor. Between the ages of twelve and fourteen he attended Adwick Hall and Storthes Hall schools and it was during this period that he appears to have been more actively engaged in field entomology than at any other time in his life. He will be remembered particularly for two youthful records: *Cerura latifascia* Curtis (= *Furcula furcula* Clerk), the sallow kitten, at Headingley about the year 1848 (Goss, 1897) and *Agrophila sulphuralis* Hübn. (= *Emmelia trabealis* Scop.), the spotted sulphur, which he rediscovered at Brandon during his school

holidays in 1845. Stainton records the incident thus: "Mr. Dunning awoke and found himself famous . . . Since he ceased to visit Brandon *sulphuralis* has been no more taken".

On leaving Inchbald's establishment he was educated privately, including a period in Paris, before entering Trinity College, Cambridge at the age of eighteen taking a classical scholarship in 1855 before becoming a law student. He gained his B.A. in 1856, his M.A. in 1859 and was elected a Fellow of his College. In 1861 he was called to the Bar. While at university Dunning initiated the formation of the Cambridge Entomological Society and established links with the Entomological Society of Oxford University, the two societies then cooperating, seemingly at Dunning's instigation, in the publication of *An Accentuated List of the British Lepidotera* (Dunning, 1858). Dunning apparently bore most if not all of the publishing costs and acted as editor and chief compiler (Goss, 1898). This interesting and learned work is mainly a discourse on the derivation of generic and species names, accompanied by fascinating biographical notes on the authors of the names.

An excellent classicist, Dunning was also multilingual in European languages, with a remarkable facility for translation at first sight of unfamiliar tongues.

He was professionally distinguished, achieving high esteem as a safe and careful counsel in court and for his re-writing of the standard work *Jarman on Wills* (McLachlan, 1897). A stroke in 1891 caused his retirement and he died in 1897 at 4 Talbot Square, Hyde Park, London.

Dunning became a Fellow of the Linnean Society in 1860 and of the Zoological Society in 1864 but it was to the Entomological Society of London which he joined in 1849 that he gave his prior allegiance. Throughout his long association with the Society he was a constant source of strength and inspiration, guiding it through the troubled years of the 1860s with an administrative skill, financial judgement and munificence without which it could well have collapsed. It is also little appreciated today that the granting of the Society's Royal Charter was the direct result of his initiative and benevolence.

Dunning's first office in the Society, which he held from 1862 to 1870, was that of Secretary, a post which he occupied with the utmost distinction throughout the troubled years of the decade. Most of his early difficulties appear to have centred around E. W. Janson, who, as an elected Fellow and an executive of the Society, was at the same time in the dubious position of being a paid official. At various times Janson held office as Curator, Secretary, Council member and Librarian, his position and activities apparently causing much friction and involving such eminent figures as H. T. Stainton, H. G. Knaggs and R. McLachlan. Dunning was drawn inevitably into controversy and was soon obliged to issue a most condemnatory report on the "state of the library" to Council. This report amounted to a complete exposure of Janson whose time as Librarian "was spent in mere chat, in chaff and badinage . . . the whole matter being a disgrace to a learned society" (Neave, 1933). One result of this succession of troubles was the disbandment of the Publication and Library and Cabinet Committees, this in turn causing a much greater secretarial workload. Dunning responded by assuming responsibility for producing the long overdue library catalogue and assuring its continuity by preparing the index for the second series of *Transactions*, organising and financing publication of the first series and by undertaking the task of Publications Editor. This he did "fearlessly and impartially, regardless of the indignation of careless authors" (McLachlan, 1897). Turning his attention next to financial matters, he produced in 1865 the first real attempt at budgetary control of the Society's affairs, his example being generally followed for years to come. A fresh outbreak of wrangling coupled with financial problems provided Dunning's next difficult, when Dr J. E. Gray, one of the trustees of the reserve fund, refused for personal reasons, almost certainly involving Janson, to release funds authorised by Council, thus creating a serious constitutional problem. Dunning once again retrieved the situation by personally financing the operation and doubtless bringing his managerial skills to bear on the underlying issues.

After relinquishing the position of Secretary, Dunning continued to advise and assist the Society. He played a significant role in the acquisition of new premises at Chandos Street in 1875, financing the entire operation, the Society thus gaining a degree of permanence

and stability previously unknown.

Dunning served on the Council in 1862 and 1876, was Vice-president in 1871, 1874, 1875, 1877, 1879, 1880, 1885 and 1890 and finally accepted the offer of the Presidency in 1883-1884. His term of office immediately followed that of another great benefactor of the Society, H. T. Stainton, who had, significantly, also previously refused the presidency. Interestingly, Stainton, doubtless as a mark of his respect for Dunning, named the moth *Lithocolletis Dunningiella* [sic] (= *Phyllonorycter nicelli*) after him (Porritt, 1883-1886).

As President in 1883, Dunning initiated a move to grant a Royal Charter to the Society. The proposal accepted, he not only performed all of the preparatory and legal work but also defrayed the entire cost. The Charter, Dunning's greatest achievement for the Society, was granted in 1885, unfortunately in the year following his term of office. His donations to the Society were in excess of £750.

Although his active association with his native county diminished over the years, the Yorkshire Naturalists' Union had cause to be grateful to him, for he remained a loyal member and generous contributor for many years. He also appears in the list of contributors to Porritt (1883-1886).

As his professional responsibilities developed Dunning's active participation in entomology lessened although he continued to publish the occasional paper, most notably the excellent works "On the genus *Acentropus*" (Dunning, 1872, 1878) and "On the 'Coffee Borer' of southern India (*Xylotrechus quadripes* Chevrolat)" (Dunning, 1868).

His interesting and generous obituary notice of the life of his friend Frederick Bond appears in *The Entomologist* (Dunning, 1889). The esteem in which Joseph William Dunning was held by his contemporaries is evident from the published obituary notices.

The annotations contained in Dunning's copy of Rennie provide an insight into the lepidoptera he encountered, giving an indication of the status of some of the species almost 150 years ago, before any major impact of industrialisation or indeed of intensive agricultural practices.

The annotations relating to Yorkshire localities are listed below, exactly as written by Dunning. Most of the species he recorded are readily attributable to modern species names; nevertheless we have included the names used by Dunning in case we have arrived at any wrong conclusion. Where we have felt the need to make any comment, this is given in square brackets after Dunning's annotation.

Dunning's Manuscript Annotations in Rennie (1932)

Pieris brassicae (Linn.) Large White

Pontia brassicae – Taken at Adwick in May 1846 and at Storthes in August 1846.

P. rapae (Linn.) Small White

Pontia rapae – Taken at Adwick in May 1846 and at Storthes in August 1846.

P. napi (Linn.) Green-veined White

Pontia napi – Taken at Adwick in May 1846.

Anthocaris cardamines (Linn.) Orange-tip

Mancipium cardamines – Taken at Adwick in May and beginning of June 1846.

Boloria euphrosyne (Linn.) Pearl-bordered Fritillary

Melitaea euphrosyne – One specimen at Adwick in June 1845. [Then considerably more widespread in the county than presently.]

Argynnis paphia (Linn.) Silver-washed Fritillary

Argynnis paphia – At Storthes Hall in Aug: /47/. The most common Argynnid. [This statement, though not referring to Storthes, now seems remarkable but it is not at variance with Newman writing *c.* 1870 or even Porritt in 1883. There are no recent Yorkshire records.]

Aglais urticae (Linn.) Small Tortoise-shell

Vanessa urticae – At Storthes on ragwort flowers in Sept. 1846.

Inachis io (Linn.) The Peacock

Vanessa io – Storthes, in Sept: 1846.

Nymphalis antiopa (Linn.)

Vanessa antiopa – Common throughout England in 1846. [A statement reflected by several Yorkshire records in that year.]

Vanessa atalanta (Linn.) Red Admiral

Ammiralis atalanta – At Storthes in Sept: and Oct. 1846 on ragwort, dahlia and asters. Attracted to ash trees in great abundance.

Cynthia cardui (Linn.) Painted Lady

Cynthia cardui – One specimen at Storthes, latter end of August 1846.

Pararge aegeria (Linn.) Speckled Wood

Hipparchia aegeria – At Adwick in April 1846.

Lasiommata megera (Linn.) The Wall

Hipparchia megaera – At Adwick in April 1846.

Melanargia galathea (Linn.) Marbled White

Hipparchia galathea – At Adwick in July 1846. [This record reflects the mid-19th century distribution of *M. galathea* about the Doncaster limestone.]

Maniola jurtina (Linn.) Meadow Brown

Hipparchia janira At Adwick in May 1846. This, next to the Cabbage is the most common butterfly. [Towards the end of the century *M. jurtina* was to decline in the west of the county until its revival around 1920.]

Satyrium pruni (Linn.) Black Hairstreak

Thecla pruni – Taken some years ago in great plenty in Yorkshire. Feeds on blackthorn. [An interesting reference to Yorkshire. The fraudulent history of the distribution of the true Black Hairstreak, to which this annotation clearly refers, was by then well known to lepidopterists.]

Quercusia quercus (Linn.) Purple Hairstreak

Thecla quercus – In every oak wood. The commonest of the genus *Quercus*. [Porritt in 1883 gives several easterly localities in Yorkshire but Dunning indicates a wider distribution.]

Callophrys rubi (Linn.) Green Hairstreak

Thecla rubi – Yorkshire Wolds (Wailes).

Lycaena phlaeas (Linn.) Small Copper

Lycaena phlaeas – At Storthes in August, September and beginning of October 1846.

Celastrina argiolus (Linn.) Holly Blue

Polyommatus argiolus – One specimen at Owston near Adwick in May 1846. Common at Storthes Hall 47/ Larvae may sometimes be taken on whin.

Cupido minimus (Fuess.) Small Blue

Polyommatus alsus – Met with in various parts of Yorkshire. Feeds on Trifolium. [Now extinct in the county.]

Polyommatus icarus (Rott.) Common Blue

Polyommatus alexis – At Adwick in May 1846, Storthes in August 1846. Commonest of the order.

Plebejus argus (Linn.) Silver-studded Blue

Polyommatus argus – Found as far north as York. Feeds on Trifolium. [Always a restricted distribution in Yorkshire, now extinct.]

Erynnis tages (Linn.) Dingy Skipper

Thymele tages – At Adwick in June 1846 and Storthes 1847. [Fairly well distributed in Dunning's time, but local nowadays.]

Laothoe populi (Linn.) Poplar Hawk-moth

Smerinthus populi – One specimen on a poplar tree at Adwick in June 1845.

Hippotion celerio (Linn.) Silver-striped Hawk-moth

Deilephila celerio – Taken at Huddersfield in 1846, one spec.

Hepialus lupulinus (Linn.) Common Swift

Hepialus lupulinus – Taken at Adwick end of May & beginning of June 1846.

H. humuli (Linn.) Ghost Moth

Hepialus humuli – At Adwick in June 1846.
Hepialus sylvina (Linn.) Orange Swift
Hepialus sylvinus – Male com. at Storthes Hall Aug. /47. Only three fem. specs. taken.
Pheosia tremula (Cl.) Swallow Prominent
Leiocampa dictaea – One specimen at Leeds in August 1846.
Nudaria mundana (Linn.) Muslin Footman
Nudaria munda – Com. at Storthes /47.
Tyria jacobaeae (Linn.) The Cinnabar
Callimorpha jacobaeae – One specimen at Adwick in May 1846.
Noctua comes (Hubn.) Lesser Yellow Underwing
Triphaena orbona – At Storthes in August 1846.
N. pronuba (Linn.) Large Yellow Underwing
Triphaena pronuba – At Adwick in June 1846. Very common in hay fields.
Triphaena innuba – At Adwick in June 1846.
N. fimbriata (Schreb.) Broad-bordered Yellow Underwing
Triphaena fimbria – At sugar in Aug. /47 at Storthes.
Xestia sexstrigata (Haw.) Six-striped Rustic
Lytaea umbrosa – At Storthes Aug. /47.
Cerastis leucographa (D. & S.) White-marked
Lytaea leucographa – Taken at York. [Unlikely to be a personal record and probably refers to the well-known Bishop Wood locality.]
Agrotis ipsilon (Hufn.) Dark Sword-grass
Agrotis suffusa – At Storthes in Sept. & Oct. 1846.
A. exclamationis (Linn.) Heart & Dart
Agrotis exclamationis – At Adwick, beginning of June 1846.
Graphiphora augur (Fabr.) Double Dart
Graphiphora augur – At Adwick in June 1845.
Diarsia brunnea (D. & S.) Purple Clay
Graphiphora brunnea – At Adwick in Aug. /45.
Eugnorisma depuncta (Linn.) Plain Clay
Graphiphora depuncta – Met with at Doncaster by H. Reid.
Xestia baja (D. & S.) Dotted Clay
Graphiphora baja – At Storthes /47.
Diarsia mendica (Fabr.) Ingrailed Clay
Graphiphora festiva – One specimen at Adwick in June 1846.
D. rubi (View.) Small Square-spot
Graphiphora punicea – At Storthes in Aug. /47.
Agrochola litura (Linn.) Brown-spot Pinion
Orthosia litura – At Storthes in abundance at sugar in Sept. & Oct. 1846.
A. lota (Cl.) Red-line Quaker
Orthosia lota – One specimen at sugar at Storthes in October 1846.
A. macilenta (Hubn.) Yellow-line Quaker
Orthosia macilenta – At Adwick in Sept. 1845. At Storthes in Oct. 1846. at sugar.
Xestia xanthographa (D. & S.) Square-spot Rustic
Segetia xanthographa – Very com. at Storthes /47.
Caradrina clavipalpis (Scop.) Pale Mottled Willow
Caradrina cubicularis – At Storthes in August 1846.
Cerastis rubicosa (D. & S.) Red Chestnut
Glaea rubicosa – At willows in April /47.
Eupsilia transversa (Hufn.) The Satellite
Glaea satellita – At Adwick in Sept. 1845. At Storthes at sugar in Sept: Oct. & Nov. 1846.
Conistra vàccinii (Linn.) The Chestnut
Glaea vaccinii – At Storthes in Sept: Oct. & Nov. 1846 at sugar.

C. ligula (Esp.) Dark Chestnut

Glaea subnigra – At Storthes, at sugar in Sept. 1846. [This is a very early date for a moth which is usually out from mid-October.]

Amphipyra tragopogonis (Cl.) The Mouse

Pyrophila tragopogonis – At Storthes in Aug. 1846. Very com. at Storthes in Aug. 1847.

Xylena exsoleta (Linn.) Sword-grass

Calocampa exoleta – At Storthes in Oct. & early part of Nov. 1846. [A moth that has declined in Yorkshire during the present century and is now very scarce.]

X. vetusta (Hubn.) Red Sword-grass

Calocampa vetusta – One spec. at sugar at Storthes Nov. 3/46.

Apamea lithoxylaea (D. & S.) Light Arches

Xylophasia lithoxylea – At Adwick, end of June 1846.

A. crenata (Hufn.) Clouded-bordered Brindle

Xylophasia rurea – At Adwick in June 1845.

A. scolopacina (Esp.) Slender Brindle

Xylophasia scolopacina – About a dozen specs., beat from Horse Chestnut at Storthes in Aug. /47.

Hyppa rectilinea (Esp.) The Saxon

Xylophasia rectilinea – nr. Sheffield. [Unlikely to be a personal record; this moth has not been recorded in Yorkshire during the present century.]

Blepharita adusta (Esp.) Dark Brocade

Hadena adusta – Sugar at Storthes (Good Insect).

Hada nana (Hufn.) The Shears

Hadena plebeia – On walls at Storthes /47.

Tholera decimalis (Poda) Feathered Gothic

Heliophobus popularis – At Storthes, one specimen on grass in Sept. 1846.

Lacanobia suasa (D. & S.) Dog's Tooth

Mamestra suasa – (one specimen in a Willow Garth at Adwick in June 1846.) ENTRY CROSSED OUT. Also by Reid nr. Doncaster. [This is a predominantly estuarine moth but there have been occasional inland records in Yorkshire.]

Mamestra brassicae (Linn.) Cabbage Moth

Mamestra brassicae – At Adwick in June, at Storthes in August 1846.

Apamea sordens (Hufn.) Rustic Shoulder-knot

Hama basilinea – At Adwick in June 1846.

Amphipoea oculea (Linn.) Ear Moth

Apamea nictitans – At Storthes on ragwort flowers in August 1846. Very abundant in July & Aug. /47. [The four species of Ear moths were regarded as one in Dunning's time; in the light of present knowledge *A. lucens* (Frey.), Large Ear is the one most likely to occur at Huddersfield, although *A. oculea* (Linn.) cannot be ruled out.]

Oligia strigilis (Linn.) Marbled Minor

Miana strigilis – At Adwick, at sugar, end of June 1846. May also include *O. latruncula* (D. & S.) Tawny Marbled Minor and *O. versicolor* (Borkh.) Rufous Minor which had not been distinguished at that time.]

Lycophotia porphyrea (D. & S.) True-lover's Knot

Scotophila porphyea – One spec. nr. Storthes Hall.

Allophyes oxyacanthae (Linn.) Green-brindled Crescent

Miselia oxyacanthae – At Storthes, at sugar, in Sept. & Oct. 1846.

Dichonia aprilina (Linn.) Merveille du Jour

Miselia aprilina – At Storthes, at sugar, in Oct. 1846.

Dasypolia templi (Thunb.) Brindled Ochre

Miselia templi – Taken a few years back at Huddersfield (Gas Lamps). [Scarce in VC63 now but often common during the last century according to Porritt.]

Polia bombycina (Hufn.) Pale Shining Brown

Polia advena – At Adwick in June 1846. [Only two records are listed by Porritt; more

widely distributed in Britain during the last century.]

Eurois occulta (Linn.) Great Brocade
Polia occulta – One spec. at sugar at Storthes Sept. 7th /46.

Antitype chi (Linn.) Grey Chi
Polia chi – At Storthes in Aug. 1846. Very com. in Aug. /47.

Acronicta psi (Linn.) Grey Dagger
Acronycta psi – At sugar at Storthes in July & Aug. /47.

Habrosyne pyritoides (Hufn.) Buff Arches
Thyatira derasa – At Adwick, at sugar, end of June 1846.

Thyatira batis (Linn.) Peach Blossom
T. batis – At Storthes in July /47.

Scoliopteryx libatrix (Linn.) The Herald
Calyptra libatrix – One at sugar at Storthes in Oct.

Achlya flavicornis (Linn.) Yellow Horned
Ceropacha flavicornis – Two specs. at sugar at Storthes March 19 & 22 /47.

Cosmia trapezina (Linn.) The Dun-bar
Cosmia trapezina – At Storthes in Aug. 1846. Beat from Ash trees. Very com. in /47.

Agrochola circellaris (Hufn.) The Brick
Xanthia ferruginea – At Storthes, at sugar, in Sept. & Oct. 1846.

Hydraecia micacea (Esp.) Rosy Rustic
Gortyna micacea – At Storthes at sugar in Aug. & Sept.

Nonagria typhae (Thunb.) Bulrush Wainscot
Nonagria typhae – One spec. nr. Storthes Aug. 28/47.

Phlogophora meticulosa (Linn.) Angle Shades
Phlogophora meticulosa – At Storthes at sugar in Sept. & Oct. 1846.

Periphanes delphinii (Linn.) Pease Blossom
Chariclea delphinii – Has been taken in Yorkshire. [We can find no confirmation of this comment; British records last century were all from south-east England, with none since.]

Abrostola triplasia (Linn.) The Spectacle
Abrostola urticae – Taken at Adwick. Storthes.

Autographa jota (Linn.) Plain Golden Y
Plusia percontationis - At Adwick in June 1846.

A. gamma (Linn.) Silver Y
Plusia gamma – At Adwick in June. At Storthes in Sept 1846.

Plusia festucae (Linn.) Gold Spot
P. festucae – taken many years ago on Scabious flowers on cross road to Braithwaite (W. & R. ?Rich).

Photedes minima (Haw.) Small Dotted Buff
Acosmetia arcuosa – At Storthes. Fem. more uncommon than male.

Mormo maura (Linn.) Old Lady
Mormo maura – Common at Storthes in Aug. /47.

Euclidia glyphica (Linn.) Burnet Companion
Euclidia glyphica – In hay fields at Adwick in June 1846. Flies in broad sunshine. [Local now in southern VC63.]

Callistege mi (Cl.) Mother Shipton
Euclidia mi – In hay fields at Adwick in June 1846. Flies in broad sunshine.

Bupalus piniaria (Linn.) Bordered White
Bupalus piniarius – At Adwick in June 1846. Beat from a scotch fir – three specimens. Males com. at Storthes /47.

Agriopis leucophaearia (D. & S.) Spring Usher
Anisopteryx leucophearia – Adwick March 46. Two specimens. In March /47 among young oaks about noon at Storthes.

Alsophila aescularia (D. & S.) March Moth

Anisopteryx aescularia – At Storthes among young oaks in March /47.

Agriopis marginaria (Fabr.) Dotted Border

Hibernia capreolaria – On hawthorn hedges in March /47 at Storthes.

A. aurantaria (Hubn.) Scarce Umber

Hibernia prosapiaria – At Storthes in November 1846. Bred female from chrysalis.

Erannis defoliaria (Cl.) Mottled Umber

Hibernia defoliaria – At Storthes in November 1846. From holly bush.

Apocheima pilosaria (D. & S.) Pale Brindled Beauty

Phigalia Pilosaria – At Storthes in Febr. 1847.

Biston betularia (Linn.) Peppered Moth

Biston betularius – At Adwick in June 1845 – One specimen found dead.

Selenia dentaria (Fabr.) Early Thorn

Geometra illunaria – At Adwick in June 1846. Beat from hedges at Storthes May.

Opisthograptis luteolata (Linn.) Brimstone Moth

Rumia crataegata – At Adwick in May & June 1846. Beat from hedges – one of our commonest moths.

Ourapteryx sambucaria (Linn.) Swallow-tailed Moth

Ourapteryx sambucaria – At Adwick, end of June 1846.

Campaea margaritata (Linn.) Light Emerald

Campaea margaritata – At Adwick in June 1846. Beat from bushes.

Alcis repandata (Linn.) Mottled Beauty

Alcis repandaria – At Adwick, in June 1846. Beat from bushes.

Peribatodes rhomboidaria (D. & S.) Willow Beauty

Alcis rhomboidaria – Very common & widely distributed.

Aethalura punctulata (D. & S.) Grey Birch

Boarmia punctularia – Common in woods in May.

Semiothisa wauaria (Linn.) The V-moth

Halia wauaria – At Tadcaster in July 1846. In garden.

Plagodis pulveraria (Linn.) Barred Umber

Numeria pulveraria – At Adwick in June 1846. One specimen beat from a beech tree. At Storthes com. [Very local in VC63 now.]

Cabera pusaria (Linn.) Common White Wave

Cabera Pusaria – Very abundant in woods.

C. exanthemata (Scop.) Common Wave

Cabera exanthemata – Very common.

Cyclophora porata (Linn.) False Mocha

Ephyta porata – Very com. in woods. [As there are only two Yorkshire records this comment presumably refers to southern English localities.]

Plagodis dolabraria (Linn.) Scorched Wing

Eurymene dolabraria – Widely dispersed.

Scotopteryx luridata (Hufn.) July Belle

Phasiane plumbaria – At Adwick, on sunny banks, in June 1846. Widely dispersed.

S. chenopodiata (Linn.) Shaded Broad-bar

Larentia chenopodiata – Very plentiful at Ridge, Adwick & at Storthes.

Colostygia multistrigaria (Haw.) Mottled Grey

Larentia multistrigaria – At palm in April & beginning of May /47.

Perizoma didymata (Linn.) Twin-spot Carpet

Cidaria didymata – Local. Very com. at Storthes.

Xanthorhoe ferrugata (Cl.) Dark-barred Twin-spot Carpet

Cidaria unidentaria – Very common.

X. spadicearia (D. & S.) Red Twin-spot Carpet

Cidaria ferrugaria – Hedges & lanes very abundant. Storthes in May.

Chloroclysta siterata (Hufn.) Red-green Carpet

Cidaria miaria – Woods & lanes. Fir wood at Storthes.

Xanthorhoe montanata (D. & S.) Silver-ground Carpet
Cidaria implicaria – Adwick & Storthes.
X. fluctuata (Linn.) Garden Carpet
Cidaria fluctuata – Plentiful in gardens. On willows latter end of April & beg. of May /47. On walls from May to Oct.
Epirrhoe alternata (Mull.) Common Carpet
Harpalyce subtristata – At Adwick in May & June 1846. Beat from hedges. Very common. Storthes May.
Ecliptopera silaceata (D. & S.) Small Phoenix
Harpalyce silaceata – Widely dispersed.
Electrophaes corylata (Thunb.) Broken-barred Carpet
Harpalyce corylata – Fir wood Storthes.
Chloroclysta truncata (Hufn.) Common Marbled Carpet
Polyphasia marmorata – At Storthes in Aug. 1846. Beat from oak trees.
Lampropteryx suffumata (D. & S.) Water Carpet
Lampropteryx suffumata – At willows in April /47 at Storthes.
Anticlea badiata (D. & S.) Shoulder Stripe
Lampropteryx badiata – At Storthes at palm in April /47.
A. derivata (D. & S.) The Streamer
Anticlea derivata – Common in gardens & woods (Adwick). At palm beg. of May /47 Storthes.
Eulithis mellinata (Fabr.) The Spinach
Electra spinichiata – In gardens & very common.
E. tersata (Linn.) The Chevron
Electra tersata – Storthes in fir wd.
Abraxas sylvata (Scop.) Clouded Magpie
Abraxas ulmata – At Hampole Wood nr. Adwick. Found abundantly in Yorks. whence sometimes called the Yorkshire Magpie. Very com. nr. Doncaster.
Plemyria rubiginata (D. & S.) Blue-bordered Carpet
Xerene rubiginata – Widely dispersed. Storthes.
Hydriomena impluviata (D. & S.) May Highflyer
Euthalia impluviata – Storthes.
H. furcata (Thunb.) July Highflyer
Phibalapteryx elutata – Com. at Storthes Aug.
Triphosa dubitata (Linn.) The Tissue
Triphosa dubitata – Widely dispersed. Walls of houses. Adwick. Storthes. [A very local moth now.]
Camptogramma bilineata (Linn.) Yellow Shell
Camptogramma bilineata – At Adwick in June. Beat from hedges & at Storthes in Aug. 1846. Beat from ash trees.
Thera cognata (Thunb.) Chestnut-coloured Carpet
Thera simulata – Fir plantations. Storthes. [Porritt had never seen this moth: Huddersfield is the only locality mentioned in his List.]
T. obeliscata (Hubn) Grey Pine Carpet
Thera variata – Very com. in fir plantations in beg. of June at Storthes.
Epirrita dilutata (D. & S.) November Moth
Oporabia dilutata – At Storthes, on ivy flowers, in Oct. 1846.
Operophtera brumata (Linn.) Winter Moth
Cheimatobia vulgaris – At Storthes in Novr. 1846. At sugar.
Chloroclystis rectangulata (Linn.) Green Pug
Eupithecia rectangulata – Very com. in gardens.
Eupithecia absinthiata (Cl.) Wormwood Pug
Eupithecia absinthiata – Common in gardens at end of June.
Odezia atrata (Linn.) Chimney Sweeper

Minoa chaerophyllata – Storthes com.

Entephria caesiata (D. & S.) Grey Mountain Carpet

Aplocera caesiata – On old walls. In July nr, Storthes.

Perizoma affinitatum (Steph.) The Rivulet

Emmelesia affinitata – Widely dispersed.

Idaea aversata (Linn.) Riband Wave

Acidalia aversata – Very common in woods.

Scopula floslactata (Haw.) Cream Wave

Acidalia floslactata – At Adwick in June 1846. [Local and seldom common now.]

Lomaspilis marginata (Linn.) Clouded Border

Poecilophasia marginata – Very common in woods throughout summer.

Semiothisa liturata (Cl.) Tawny-barred Angle

Macaria liturata– Fir wood at Storthes.

Cilix glaucata (Scop.) Chinese Character

Cilix compressa – Very com.

Hypena proboscidalis (Linn.) The Snout

Hypena proboscidalis – At Adwick In June 1846

Herminia nemoralis (Fabr.) Small Fan-foot

Polypogon nemoralis – Com. at Storthes, end of May & June.

Aglossa pinguinalis (Linn.) Large Tabby

Aglossa pinguinalis – Very com. [A scarce moth now but common in stables last century.]

Evergestis forficalis (Linn.) Garden Pebble

Botys forficalis – At Hampole Wood in May 1846.

Margaritia sticticalis (Linn.)

Margaritia tetragonalis – 3 specs. at Storthes. [This is presumably the same record as Huddersfield, August 1847 (P. Inchbald) (Porritt, 1883-1886). There was to be no further VC63 record until August 1995.]

Pseudoips fagana (Fabr.) Green Silver-lines

Chloephora fagana – Common in woods.

Pterophorus pentadactyla (Linn.) White Plume Moth

Pterophorus pentadactylus – At Adwick, in June 1846.

Platyptilia gonodactyla (D. & S.)

Pterophorus trigonodactylus – Taken in Yorks.

Alucita hexadactyla (Linn.) Twenty-plume Moth

Alucita hexadactyla – Common in houses from March to Oct.

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USING DIPTERA IN ASSESSING SITE QUALITY, WITH PARTICULAR REFERENCE TO EMPIDOIDEA – A REGIONAL PERSPECTIVE

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The setting aside and management of areas for the purpose of nature conservation is now regarded as a legitimate use of land, and in these rapidly changing circumstances it is essential that planners and land managers should have at their service the best available information on the conservation value of sites in order to assist them in making decisions.

Historically, sites have been assessed chiefly, but not always, on their botanical quality, and this will no doubt continue to be the case. However, in recent years, largely as a consequence of pioneering field surveys undertaken by entomologists, insects are now increasingly being taken into account in the assessment and management processes.

Recording the distribution of plants and animals on the basis of the Watsonian vice-counties has a long history, and is still being used, for example, in the "Distribution" statements for scarce and threatened flies in Falk (1991). With regard to the five vice-counties which make up the historic county of Yorkshire, we are fortunate to be able to draw upon the records of Diptera, and in particular the Empidoidea, amassed by collectors over a period of more than eighty years.

Many assessments of site quality begin with the gathering of data which demonstrate the diversity of the fauna and flora. The object of a Species Quality Index is to introduce into the data, where possible, some allowance, or weighting, for the scarcity or commonness of the individual species making up the list.

The Species Quality Index as applied to the Empidoidea is a system based upon an arithmetical "rarity score" being given to every species, and the principle should be capable of application to many well-studied families of Diptera. The "rarity score" is determined by national or regional rarity as currently understood; for example, all Red Data Book species (in practice, those believed to occur in fewer than 15 of the 10km squares of the National Grid) are awarded a score of 32, whilst common and widespread species are given a score of 1. The score for all species recorded from a particular site are combined and the total is then divided by the number of species at the site to produce the Species Quality Index. This and other indices are described in Procter (1994). Because of the considerable quantity of Yorkshire records, it is also possible to introduce scores relating solely to the county (Table 1).

TABLE 1
Species Quality Index: Scores and Regional Weighting
Diptera: Empidoidea.

Scores per species			
Red Data Book (all grades)		RDB	32
Nationally Notable		Nb	16
Regionally scarce (YNU records): species present in:			
1	10km square		8
2-5	10km squares		4
6-10	10km squares		2
11+	10km squares		1

(Note: "National" scores override "Regional" scores in the case of RDB and Nb species).

For each site the total species score (the "rarity score") is divided by the total number of species (the "diversity") to give a "Species Quality Index" for the site.

One advantage of a scoring technique is that it enables sites to be ranked in order of species quality for the group under consideration. Table 2 demonstrates the results of this technique when applied to a number of woods across Yorkshire. In most cases visits were spread throughout the field season (usually from May to September), and all collecting was done by sweep-netting. The results clearly indicate that a large species diversity at a site does not necessarily indicate a high quality.

In Great Britain this scoring technique was originally pioneered by coleopterists in studies of water-beetles (Foster *et al.*, 1990). These are continuing, and species quality indexing is now also being used for Aculeate Hymenoptera (Archer, 1993).

TABLE 2
Species Quality Index – Selected Yorkshire Woods
Diptera – Empidoidea.

Site	No. of visits	No. of species	Total "score"	S.Q.I.
Birk Crag Wood, Harrogate	5	96	131	1.36
Middleton Wood, Ilkley	5	50	69	1.38
Birkham Wood, Knaresborough	8	104	215	2.07
High Spring Wood, Richmond	5	103	288	2.80
Duncombe Park, Helmsley	13	147	555	3.78
Hag Wood, Richmond	5	61	244	4.00
Averages for 16 Yorkshire woods (including the above sites)		94.7	237	2.50

A "scoring" system is inevitably based upon a changing scenario; the scores for individual species will change as knowledge of distribution advances; for example, in a regional context a species once known from only one 10km square should, under this system, move down a grade when further specimens are found in additional squares. Numerical scores ought, ideally, to be constantly changed in the light of fresh discoveries, some of which may reflect a true extension of range. This, however, is clearly impractical in a manual system, and for the time being I work on the basis of regional scores which I last revised in 1992.

The scoring system as outlined here can only be applied with any degree of confidence in

egions where the fauna is well-recorded and the relative scarcity or abundance of different pecies is well known.

This system can be used in support of other data. It is generally accepted that no single roup of organisms can be used in isolation to assess the value or quality of a site: a range f organisms must be taken into account in making value judgements. However, where hey can be applied, Species Quality Indices introduce a limited element of objectivity in espect of the fauna of sites which has hitherto been lacking.

The Superfamily Empidoidea comprises approximately 650 species representing about 0% of the British Diptera fauna. Species exhibit a wide range of life-histories and habitat references and some are regarded as useful indicator species of ancient woodland. The tatus of many species is well-known and the Superfamily contains a fairly average roportion of rare and uncommon species which has recently been reviewed nationally Falk and Crossley, in press). This is therefore an ideal group with which to work in site ssessments, and other families of Diptera ought to be equally useful, especially the ipulidae and Syrphidae.

It is recognised that not all Diptera are suitable for evaluating every type of habitat. Empidoidea, for example, are probably of little value in assessing the quality of dry grassland. There are also obvious limitations to the scheme as outlined here, not the least being that it does not take into account collector effort or collector bias. Neither is llowance made for species-richness which by itself may be a significant factor in assessing ite quality in some cases; nor is the age, vegetation structure or size of the habitats taken nto account.

However, notwithstanding these shortcomings, this paper is presented at this time in the ope that it will encourage and challenge others to take up the idea and develop it for the enefit of present urgent conservation needs, and also in the longer term interests of Dipterology.

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BOOK REVIEWS

Naturalists' Summers by **Ann Tate**. Pp. 192. Cassell, London. 1994. (For a signed copy of the book, send a cheque for £6.00 to Ann Tate, 15 Shipston Hill, Oadby, Leicester LE2 5PS).

Ann Tate, a widely recognised writer on Countryside matters, and member of many naturalist organisations, wrote this informative and fascinating book in celebration of the fiftieth anniversary of the Field Studies Council in 1996. Created to educate the public in all aspects of rural life, the FSC still attracts many students of all ages and abilities to

courses at its centres scattered throughout Britain. Ann first attended one such course, on Pond Life, at Flatford Mill in 1952, and has remained hooked on such functions ever since.

Field Studies Council courses are run by specialists in their field and cover many disciplines concerned with the interpretation of the countryside. This book provides detailed accounts of 24 such courses which the author attended, at centres from Devon to the Isle of Skye, and including Yorkshire. As noted in David Bellamy's introduction, the result is a book packed with the accumulated wisdom from leaders in various aspects of Mammalogy, Ornithology, Herpetology, Entomology, Conchology, Bryology and Botany. Inevitably, students on many such courses can find themselves on the frontiers of knowledge in the respective fields, and the author has captured something of the exhilaration of these occasions in her entertaining style. This book is also highly instructive. The reviewer can vouch for the author's grasp of complicated concepts and technical words, as her treatment of a course which he led on the Insects of the Cow-dung Community has been widely hailed as something of a classic. Indeed, several individuals were prompted to pursue research in this field after reading her account.

Apart from the main text and introduction, there is a list of organisations concerned with Countryside and Wildlife, and a bibliography for the subjects discussed. The book is attractively and profusely illustrated with photographs by the author and pen drawings by Geoffrey Herickx.

Naturalists' Summers deserves a place in the library of all who love the countryside. After reading this book, with its remarkable insight into all manner of curiosities, a country walk will never be quite the same again.

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Charles Darwin: the Man and his Influence by **Peter J. Bowler**. Pp. xii + 250, including 15 black and white plates. 2nd edition. Cambridge University Press. 1996. £35.00 hardback; £12.95 paperback.

The reissue of this book by Cambridge University Press (first published by Blackwells, Oxford, in 1990) is an indication of the importance of the work. The author (who is Reader in the History and Philosophy of Science at the University of Belfast) is at pains to stress that the book "is **not** a biography in the conventional sense". Indeed in his preface he looks forward to the publication of a "really detailed biography" that makes full use of the findings of modern scholarship: since he wrote this, at least three such full-length biographies have appeared. Peter Bowler has, as he himself puts it, "taken a different tack". He has written a book that takes account of the detailed work on Charles Darwin now available, but which "is written at a level that will allow ordinary readers and students to gain some appreciation of the problems that confront specialist historians". He aimed, amongst other things, to demythologise Darwin, dispelling certain errors that have been perpetuated – for example that it was the *Beagle* voyage in general, and the visit to the Galapagos Islands in particular, that were responsible for the conversion of Darwin to an evolutionary outlook. He also takes the standpoint that a scientific enterprise is a social phenomenon, and makes a special effort to examine both the social influences on Charles Robert Darwin (1809-1882), and his influence on society – to put the man into his context.

Despite these emphases, the arrangement of the work is chronological. After a chapter entitled "The problem of interpretation" in which certain misconceptions that have appeared in writings about the great Victorian naturalist are identified, there is a chapter on "Evolution before the *Origin of Species*". "The young Darwin" then places the subject in the context of his family, his time as a medical student in radical Edinburgh (which Peter Bowler thinks has been much underemphasised in its influence) and later in that of more conservative Cambridge. The voyage of the *Beagle* itself is next discussed, before what are here regarded as "The crucial years", the period in London from 1837-1842, when he associated with Britain's scientific élite. The next two chapters overview the long years of development of the "species theory" after the move to Down House in Kent, and "Going

public" following the communication from Alfred Russell Wallace (1823-1913) in 1858 that vouchsafed that he was on a similar path to Darwin, although Bowler emphasises that Wallace approached it from a different angle. Throughout, stress is placed on the milieu in which Darwin lived and worked, as well as on the scientific theories themselves. The emergence of "Darwinism" in the years following the publication of the *Origin of Species* is then considered, along with an excellent discussion of "The opponents of Darwinism". Chapter 10 on "Human origins" similarly places strong emphasis on the receipt of Darwin's ideas in the intellectual community. The final chapter on "Darwin and the modern world" briefly reviews the development of evolutionary ideas in the century since Darwin's death.

Despite the conventional structure of this book, when first published over half a decade ago it cut new ground, not only by placing Darwin so firmly in his social milieu, but because it illustrated the complexity of his character, and the contradictions and the anachronisms in his life and work. In its relatively brief compass we come to appreciate, almost to like, this man who was part conservative, part radical, sometimes maintaining strongly a theistic position, sometimes drifting away from it. The book is easy to read, the style having a pace that carries the reader along splendidly. Adequate notes on sources are given, yet these do not overwhelm the text. There is a full bibliography and good index. A series of clear plates provides portraits of many of the associates of Darwin – those influencing and influenced by the greatest of all naturalists. Darwin scholarship – what Peter Bowler calls the "Darwin industry" – has moved on to some extent since this book first appeared, but the work still represents an excellent summary.

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